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POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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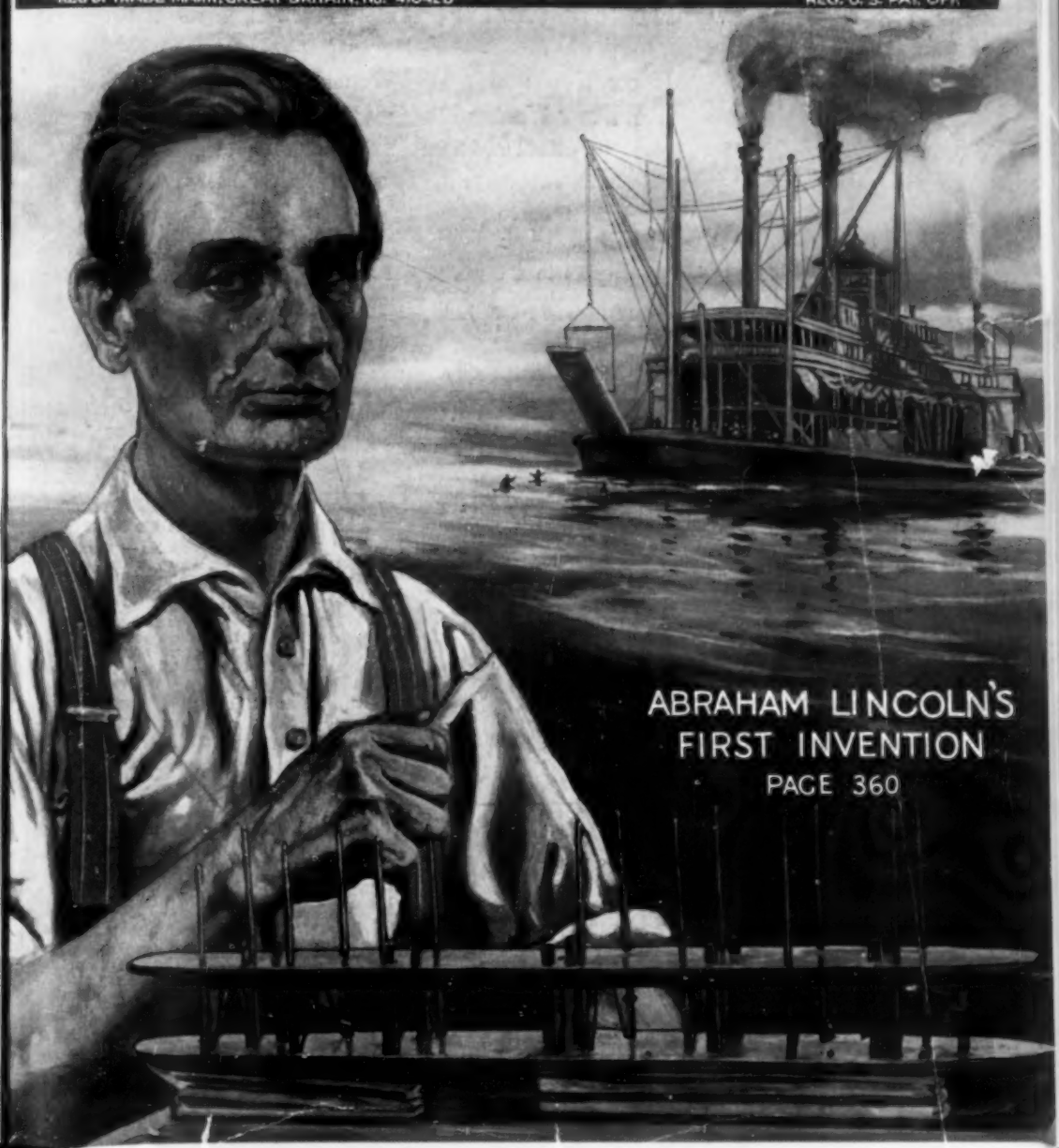


ABRAHAM LINCOLN'S FIRST INVENTION

PAGE 360

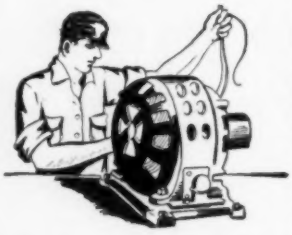
In 50 Days You Step Into a Real Job for Life at Big Pay

McSweeny Trained Men are Reaping a Harvest of Wages

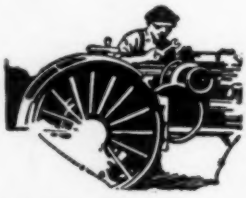
Be an Auto, Tractor and Electrical Expert

Read what G. W. Smith, a McSweeny School Graduate, writes:

Dear "Mac":—
Since completing your course I have made $800 a month with my garage and agency. I owe this all to you.
G. W. Smith,
W. Alexandria, Ohio



Here is a McSweeny student working on a modern dynamo. Nothing electrical puzzles these fellows.



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Colby Lord, Oakland, Maine.

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Do Wages From $40 to $150 a Week Appeal to You?

If so, sign and mail immediately the coupon below.

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Write for My Special Tuition Offer

The Rahe School of Cincinnati, Ohio, which, through the untiring efforts of J. H. McSweeny is rated among the best schools in the world, will now be known as the **McSweeny Auto, Tractor & Electrical School of Cincinnati, Ohio.**

The Great McSweeny School

McSweeny has successfully managed more Auto Schools than any man in the United States, and will now devote his entire time and attention to the McSweeny School of Cincinnati.

"Mac" has trained thousands of men. They are making good. Read what they have to say. Many own their own garages. They are making real money.

Are You Satisfied With Your Pay Envelope?

Are you contented? Ever wonder what you will be earning 10 years from now? Would you like to be your "own boss;" like to be somebody in your town; like to have work at **real** wages **every** Day? Then you need to know what the **McSweeny Auto, Tractor and Electrical School** means to you, your pocketbook and your future.

Complete Auto, Tractor and Electrical Course Included

McSweeny offers without cost to every student complete instruction in general electricity: house wiring, motor and generator construction and automotive electricity.

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Ask yourself that question — then read the answer here. Here you learn everything about the auto and tractor—engine, ignition, starting, lighting, carburetor, vulcanizing, welding, batteries, clutches, gears, differentials—absolutely everything. In 50 days you can tackle any auto or tractor in any condition and "put it on its feet."

Here Is Your Chance to Clinch Your Future —Don't Delay a Day

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Without any obligation, send me your big free book, "The Evolution of Transportation." Also information regarding special temporary tuition offer.

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Successors to Rahe Auto & Tractor School, Cincinnati, Ohio

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EACH Eveready Radio Battery represents thirty years of battery building experience. Each Eveready Battery represents millions of dollars invested in men, methods and machinery. Overseeing Eveready production is the greatest battery laboratory known to science, where every particle of raw material is required to pass Eveready's exacting tests. To insure Eveready serviceability, batches of Eveready Batteries are constantly being set aside for performance tests. And, finally, daily shipments keep dealers supplied with fresh Eveready Batteries, packed full of power.

To be certain of battery satisfaction, insist on Eveready Radio Batteries.

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This battery is a wonder worker

Eveready's biggest contribution to economical and more satisfying radio is the Eveready "C" Battery, a triple-use, universal battery. It will make the loud speaker respond with a new fullness and naturalness of tone, and save much money by making the "B" Battery last still longer. Connect it with the grids of audio frequency amplifiers and notice the big difference. Can also be used as an "A" Battery for 199-type tubes in portable sets, and as a "B" Battery booster. Eveready Radio Battery No. 771—use it!

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"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"

Ship Tossed High on Rugged Coast

Grounded on the sands in a bay off the coast of Cornwall, a staunch motor schooner was tossed like a chip upon the rocks where it was left high and dry by the receding tide. The boat's powerful engines were unable to free it from the clutches of the shoals, and after a day of battle against the sea, it suffered a fate like that which has overtaken sailing vessels and many small, fragile craft wrecked against the steep cliffs that line the shore.

Popular Mechanics Magazine

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 41 MARCH, 1924 No. 3

Model Making Unites Business Men

THROUGH a recent exhibit of many products of skilled craftsmanship, attention has been directed to one of the unique organizations in the country —the Chicago Society of Model Engineers.

Banded together by the lure of a common hobby and with no thought of gain, the members pursue their regular occupations as lawyers, brokers and business executives during the day, but at night they retire to their workshops to construct miniature locomotives, steam rollers, torpedo boat destroyers and marine power plants.

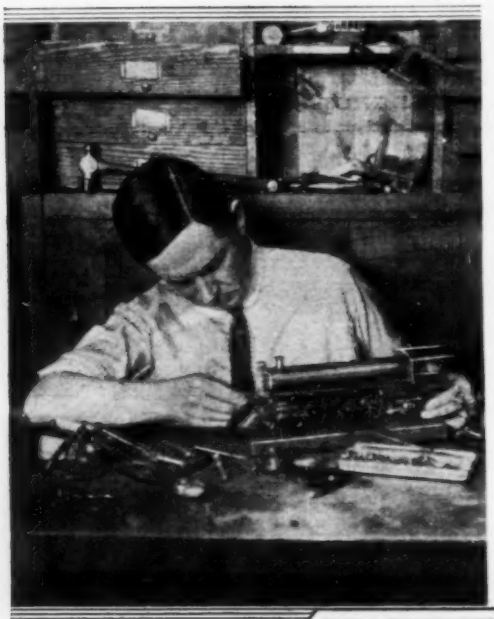
Twice every month they all meet in a little laboratory in the heart of Chicago's business district to discuss problems or to avail themselves of the more complicated machines that are not available in their homes. To reach this shop they have to climb eight flights of stairs. A glance inside reveals what appears to be a toy factory or a Lilliputian foundry in full blast, but a closer inspection shows that the machines being built are not playthings, nor are the workers busy with any ordinary tasks.

Toiling with the diligence of a fireman, a staid business man is shoveling coal into the tender of a perfect model of a Pacific type locomotive capable of pulling 900 pounds. He is the maker of the engine and stops work long enough to describe the mechanism. It is constructed of steel, copper and brass on a three-quarter inch scale. The boiler will generate 85 pounds of steam, and enough fuel is carried for a three hours' run. The model is complete in every detail including air brakes. Spare hours for two years were devoted to the task of fashioning the engine and it is not yet completed.

"I would not like to sell it," the builder replies to a question. "I didn't make it for that purpose."

Nearby is a complicated model of a triple expansion marine engine and boiler of the Yarrow type. The power plant with shaft and propeller attached, is an exact duplicate, except in size, of that commonly installed in large ocean liners. Piston rods and the propeller shaft move as compressed air is let in through a small pipe.

Then there are replicas of German and English types of railway locomotives complete with air brakes that operate, quickly stopping the engines as they glide over small tracks. Inside one of the boilers twenty-six flues have been installed exactly as they are in the large locomotive,

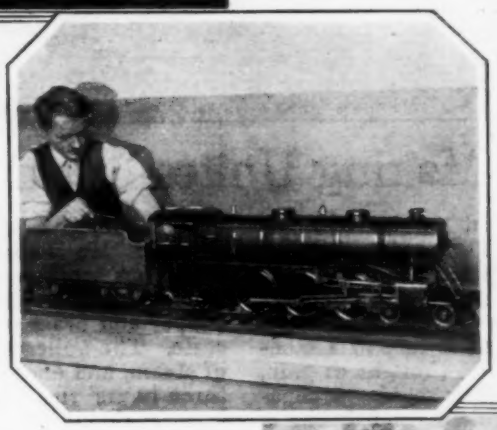


there are almost as many occupations represented as there are members. Engineering training is not demanded to make anyone eligible to join. The only requirements are that the applicant must be at least eighteen years old, a stipulation put in because it was believed that younger persons might damage the club's equipment, and that the candidate must "love mechanics."

When meetings are in session or the members are at work, it is a common sight to see a court reporter getting ideas from a plumber on how to install flues in a boiler, a musician and a lawyer discussing a knotty problem in valves with a locomotive designer, while an auditor, a high school teacher, and a book publisher receive help in interpreting a blue print from a draftsman.

Technically trained members are in the minority, but their knowledge is a great help to the others, and this sharing of experience is one of the chief benefits of the society, the members declare. Ages run from 18 to 71 years, and the men are free to design and construct any sort of machine that strikes their fancy.

All work is done from drawings and with special tools that have been purchased for the use



for these craftsmen are not content with outside appearance alone.

Other miniatures include various kinds of marine engines, a speed launch, small steam rollers, stationary engines, and a torpedo boat destroyer run with steam generated from a blow torch flame. Tiny lathes, a model of a breech loading coast artillery gun that fires a .38 caliber cartridge, small sailing vessels, and many machines yet in the process of development.

Founded in 1914, the society has grown from the three men who met at the invitation of the founder to a membership of 172. Non-resident members are scattered from Vermont to California. Frequently, a model maker from a remote section happens into Chicago and explains that he cannot proceed with his machine because of lack of parts, or because he is stopped by some technical problem he is unable to master. The materials are found by his fellow members, and the confusing question worked out with the aid of others who have had engineering training.

One unique feature of the society is that

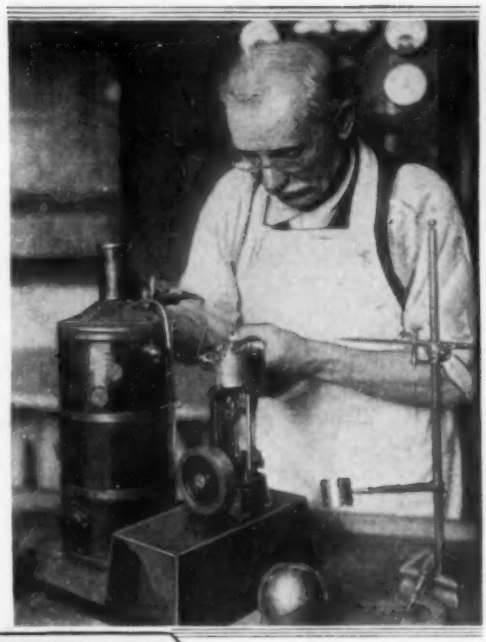
Miniature Locomotives that Run, the Work of Model Builders, Constructed during Their Leisure Moments

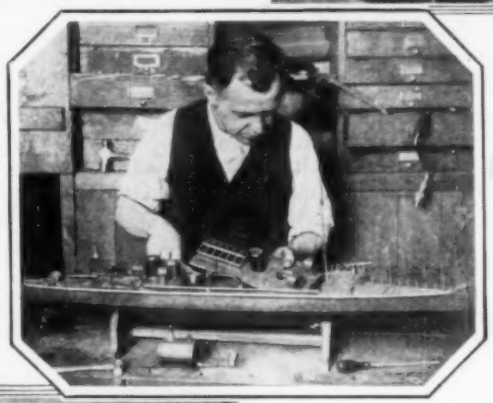
of the organization or are owned privately by the members. Most of the model engineers have workshops in their own homes, and construction done there is supplemented at the club shop where the benefit of suggestions from others may be received.

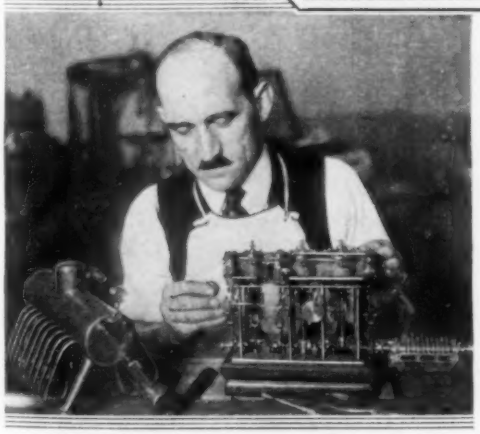
The society had its inception in the mind of a draftsman who had been fashioning models of electrical machines as a pastime and desired the assistance and companionship of others who, he thought, might be interested in the same sort of recreation. Meetings were first held in a downtown office, but a workshop was later rented and equipped.

The plan of the founder, that the club should be devoted wholly to model making as a recreation and not for profit, has been strictly followed. One member in the East recently used his skill to assist a large railroad company in preparing a model of its "crack" locomotive for display in an advertising parade and has also made models of the engines used by the Central Railway of Brazil, but he is perhaps the only one who has done any strictly commercial modeling. The others follow the work simply as a pastime.

"It's a relief after a day in the office to put on working clothes, get out my tool kit and tinker away at my model," said one of the members, a clerk. "I forget all about cares of the day. I learn valuable facts about machinery and pick up many interesting and worthwhile bits of knowledge from the other members in the club. Model making is a more satisfactory recreation than golf, for it can be pursued regardless of the weather. Then, too, the women folk like it because it keeps us men home."







Steam Engines, Fast Boats and Complicated Marine Power Plants Are Exactly Duplicated in Miniature

"A powerful locomotive, to my mind, is one of the handsomest and most inspiring things in the world," said another member. "I get a lot of satisfaction in trying to make a model of one, just as an artist, I suppose, gets delight in painting an image of what he considers beautiful."

A permanent museum in which the models will be displayed for historical and scientific purposes and branch chapters of the society in other cities are contemplated by the organization.

In the meantime, the collection of skillfully fashioned machines increases as lathes turn and tools are guided by the hands of the craftsmen who have found pleasure and benefit in their hobby.

WOOD CARVER'S ART RIVALS SCULPTURED WORK

Preparing Pieces of Wood for Assembling in Carved Pictures that Get Their Colors from Natural Shades of Lumber. Right and Left Are Specimens of Finished Panels

Rivaling the art of sculpture, figures produced by a wood carver contain bits of material that give them an appearance resembling natural colorings. In cutting and assembling pieces of rare lumber, it is said that the craftsman has found a new method of forming the subjects. Entire panels, ornamented by delicately marked moldings, are created by his tools in imitation of framed pictures, with scenes of bird life as their principal features. The wood is shaped in relief for lifelike effects.

LIGHT TOUCHING ELECTRIC EYE ACTS AS BURGLAR ALARM

As sensitive to light as a human eye, an electric device has been made in Germany that is intended to be placed in vaults, and other dark places where valuables are stored, to act as a burglar alarm. The flame of a match, the opening of a door or the barest glimmer of light admitted by an intruder, is sufficient to complete an electrical circuit and set off an alarm. So small that it may be hidden on a desk, behind a clock or beneath a pile of papers, the electric eye, which consists of a small cell filled with the chemical element called selenium, is covered during the day.

Electric Eye Used to Detect Thieves, a Glimmer of Light Being Sufficient to Sound an Alarm

MAGNETS LAY NAILS STRAIGHT IN PACKING BOXES OR KEGS

To lay nails straight in containers, a packer equipped with magnets is reported to have been built by a Swiss inventor. The machine is said to be able to fill kegs, boxes, or paper cartons and to handle wire rods, hairpins, knife blades and fishhooks with equal ease. The articles to be boxed up are poured into a huge vibrating hopper in lots of about a thousand pounds and are straightened out on large trays below.

WATER CURTAINS GUARD WALLS OF SKYSCRAPER FROM FIRE

So that it can be surrounded by curtains of water to protect it from fire in adjoining buildings, a sprinkler system has been installed on the roof of a Cincinnati skyscraper. This was done after a disastrous conflagration in Chicago proved that a supposedly fireproof building is not immune from the intense heat that is radiated from blazing structures near by. The sprinklers are so arranged that streams of water can be shot directly upon the wire glass windows from the seventeenth to the lower floors. A steam pump, with a capacity of 750 gallons a minutes, and an electric pump, of 1,800 gallons' capacity, placed twelve feet above the basement as a precaution against floods, provide the necessary pressure. The pipes are of galvanized iron and are fastened by connections in holes drilled into the building.

LIMOUSINE FOR MOTORCYCLE BUILT ON SIDE CAR

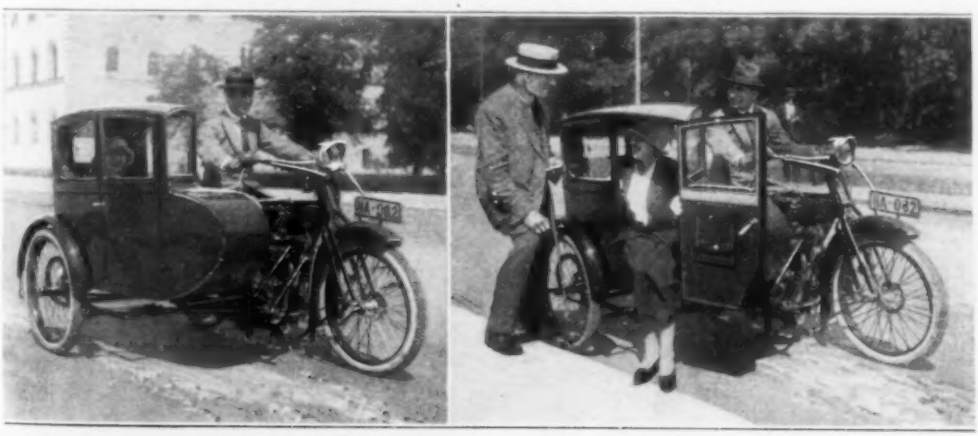
For carrying a passenger in comfort during all sorts of weather, a side car for a motorcycle has been designed with a limousine top by a German manufacturer. The attachment is upholstered, and seats one person. A door with a glass panel opens the full length of the covering, and the floor is within one step of the ground. The body is built along regular automobile lines and is beautifully finished. Windows can be lowered to admit air, or the entire hood can be closed in rough weather. Owing to the small size of the vehicle, it can traverse narrow or crowded streets with less difficulty than the ordinary cabs.

CRACKS AS STACK FALLS TELL OF GIANT FORCES AT WORK

How the forces of gravity, an explosive and air pressure act, is shown in a remarkable photograph of a smokestack,

Falling Smokestack with Cracks Showing Clearly the Tremendous Forces Pulling It to the Earth

taken as it plunged to the earth in England. Great cracks along its side indicate where the blast exerted an upward pressure, destroying the balance of the column. Then gravity pulled it downward relentlessly. The upper part, however, fell more slowly than the lower, because of the greater resistance of the air and its smaller mass. The bricks, of which it was estimated there were more than 575,000 in the stack, will be used for building.

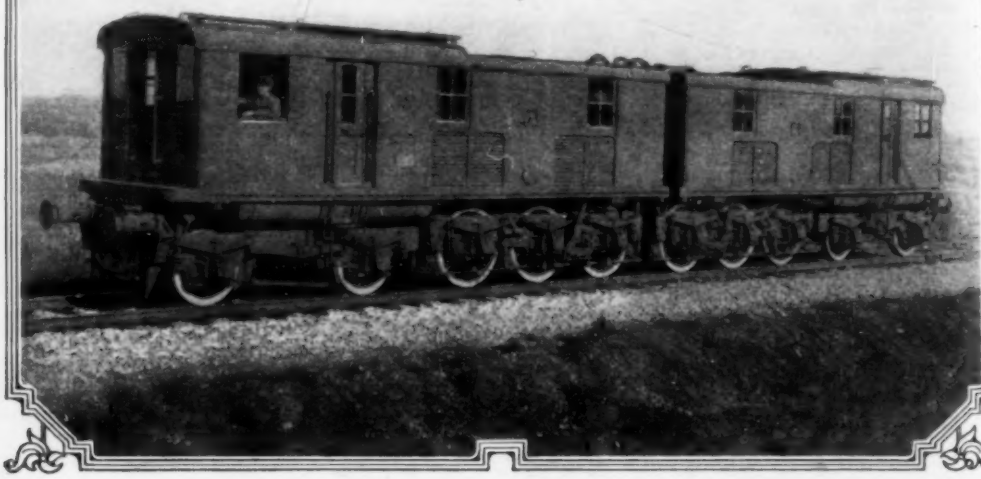


Left, Limousine Side Car that Carries One Passenger, Attached to Motorcycle; and Right, Showing the Wide, Full-Length Door that Makes Entrance and Exit Easy for Occupant

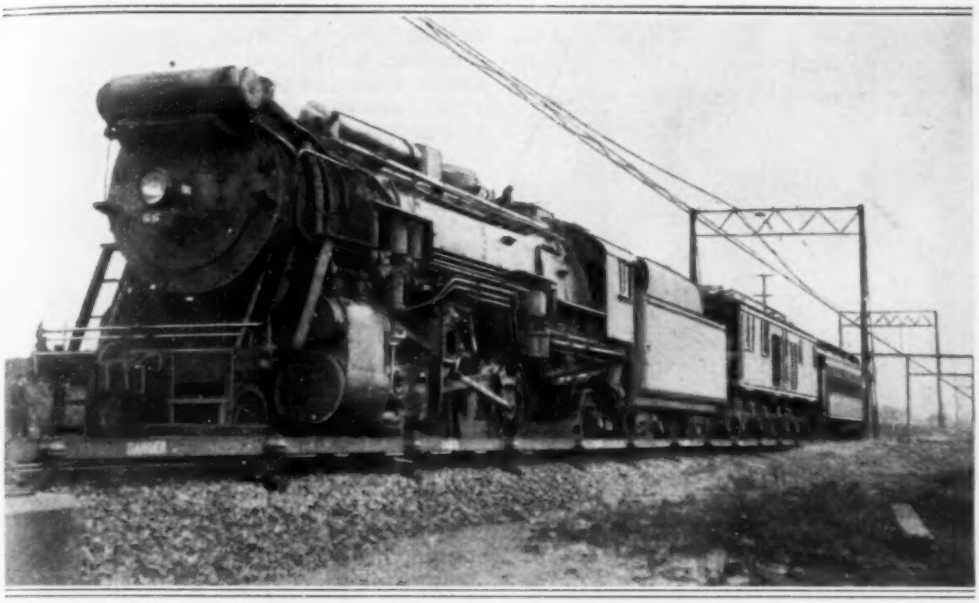
Steam Goliath Built to Negotiate Mountain Grades with Heavy Trains of Freight

—o—

Electric Locomotive that Equals Its Coal-Burning Rival in Speed and Strength



ELECTRIC LOCOMOTIVE IS VICTOR IN TUG-O'-WAR



"Tug-o'-War" between Two Giants of the Rails, a Steam Locomotive Constructed for a Mexican Railroad and an Electric Engine Designed for Use in France

Two monsters of the rails, one operated by electricity, or "white coal," and the other by steam, staged a spectacular tug-o'-war at Erie, Pa., recently before railway officials from all parts of the country. Puffing and snorting, with its huge driving wheels turning ahead, the steam locomotive was pulled backward, despite its utmost efforts to hold its own. Both engines were of the same weight. The steamer is one of ten built for service in Mexico, where it will haul freight over grades twice as steep as those usually found in the United States.

HANDY CAMERA TAKES "MOVIES" AT TOUCH OF BUTTON

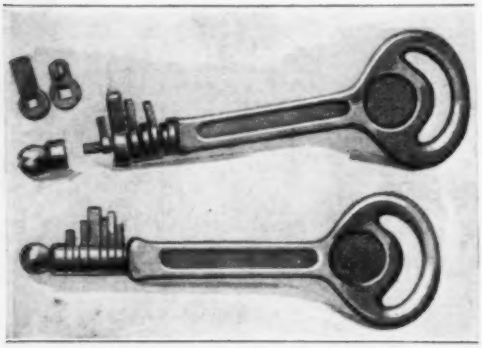
At a touch of a button on a motion picture camera designed somewhat like a pair of field glasses and carried conveniently by the side in a handy case, "movies" and other scenes can be taken without the use of a tripod, complicated focusing apparatus or a bothersome crank. A spring mechanism released by the button turns the reel which holds the equivalent of 250 feet of standard film, or 4,000 separate views, in one loading. A telescopic view finder at the side shows exactly what will appear on the negative, and the camera is so easily manipulated that with one hand, a fisherman may take pictures of the fish he is attempting to land with the other. It may be used with tripod if desired and is loaded in daylight. For use with the camera a small projector has been made which shows flickerless pictures in sizes ranging from that of a calling card to seven feet by nine feet. The machine can be used with direct or alternating current, stops, starts and reverses at the touch of a button, and is equipped with a current regulator that weighs only three ounces. The film is non-

Landing Fish with One Hand and Taking "Movies" of Struggle with the Other

inflammable and may be halted at any place in the reel for a "still."

ADJUSTABLE TEETH ON KEY FIT INTO CHANGEABLE LOCK

So they may be changed from one adjustment to another, a lock and key have been patented in Germany with a loose arrangement of teeth. The levers and springs of the lock can be set in several different combinations and the key has detachable teeth that can be placed in corresponding positions. House owners can prevent intruders from becoming acquainted with the plan of the lock by resetting it frequently. If the key is lost another can be secured and the entire device changed. They are easily attached, and may be set by an inexperienced person.



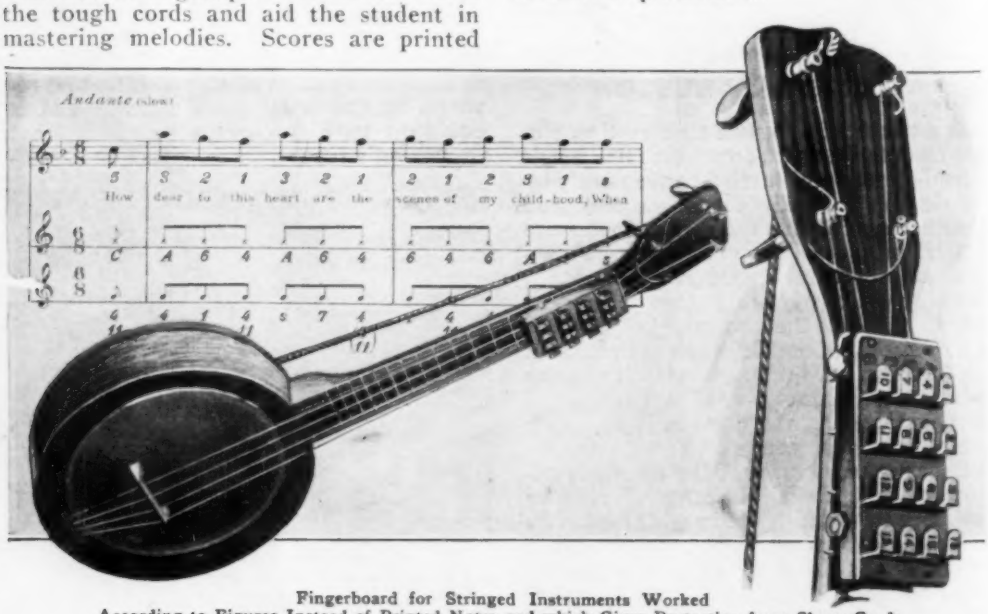
Adjustable Key Teeth that Can Be Changed to Fit Any Position of Lock's Levers

SIXTY MILES OF PIPE TO BRING WATER FROM MOUNTAINS

To bring mountain water to Tulsa, Okla., from a source sixty miles away in the Spavinaw hills, a pipe line five feet in diameter is being laid. Scheduled to be completed early in the spring, it will carry the fluid to a community of 100,000 persons at the rate of 25,000,000 gallons a day. The water will be brought to a low spot within five miles of the city by gravity, and from there pumped to a second reservoir on the highest of the surrounding hills. The system is declared to be one of the longest gravity pipe lines in the world, and will cost approximately $7,000,000.

FIGURES REPLACE NOTES TO AID STRING PLAYERS

So beginners and those not familiar with the musical scale may easily play stringed instruments, players have been patented that "finger" the notes. Made to fit the necks of banjos, mandolins, and similar devices, the apparatus has numbered keys that relieve fingertips from contact with the tough cords and aid the student in mastering melodies. Scores are printed with figures to correspond with those on the player, instead of being written in the usual symbols and characters. The appliance can be quickly attached and is made entirely from metal. It may be moved to any position on the keyboard to suit the performer.



Fingerboard for Stringed Instruments Worked According to Figures Instead of Printed Notes and which Gives Protection from Sharp Cords

AIRPLANE IN CHURCH PAINTING HAS SAINT AS PATRON

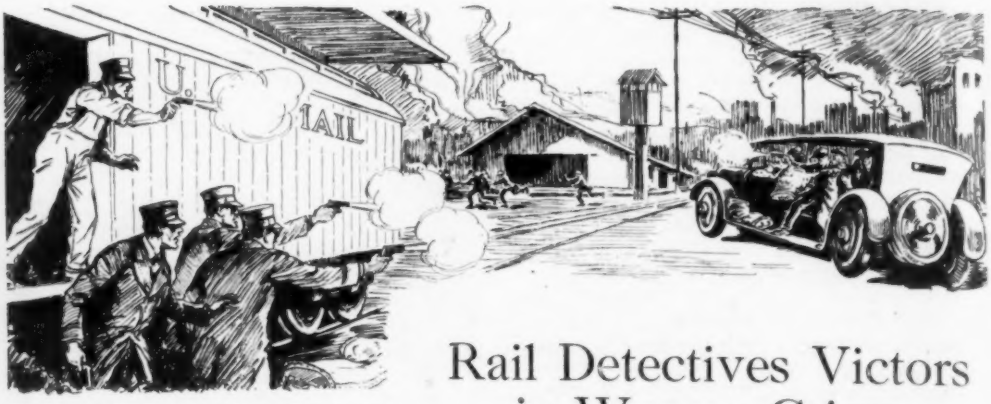
Adapting the airplane, locomotive, and automobile to motifs for religious frescoes, a French artist has achieved unique results in the decorations on the walls of the new church of St. Christopher, the patron saint of those engaged in hazardous occupations, recently completed in Paris. The figure of the saint is seen protecting a falling aviator, an engineer, and a speeding autoist. The machines, shown in detail, form the chief note in the designs and the imminence of danger is effectively suggested. The building has become known as the "sportsmen's church," and the novel decorations have caused wide comment.

CAMERA FOR SURVEYING SAVES BOTH TIME AND LABOR

For registering ground dimensions, a photographic system of surveying, recently devised by a London, England, man, is said to produce results of greater accuracy than the ordinary methods. In using a camera instead of the transit, it is claimed that fewer field operatives are necessary and that the office work of mapping the plot from the records can be divided among as many persons as desired, thus saving much time for completion of the task. In setting down the measurements of the land formations from the photographs, it is said, no difficult mathematics are necessary. More data are also gathered by the process, and since the same man seldom does the field work and makes up the drawing, the one doing the drafting has an exact picture of the area to guide him. In a recent test the system measured dimensions of rises and depressions within a half of one per cent of absolute accuracy.

POLICE LEARN EYELID TALKING TO BALK THE CRIMINAL

Detectives in Canada are being taught a code by means of which they can communicate with one another by dropping, raising or other movements of the eyes, and also how to "talk" secretly by means of finger touches, by twisting of a cigar, fingering of a mustache and twiddling fingers behind the back. This is being done so that they can transfer their thoughts when in the presence of criminals or prisoners. It is declared that communication with the eyelids can be as rapid as the ordinary man typewrites.



Pistol Battle Between Mail Guards and Would-Be Robbers

Rail Detectives Victors in War on Crime

WHERE are the James boys and the "Bill" Daltons of yesteryear? What has become of the picturesque train robber who, with a gun in each hand and his eyes boring his victims from above a black silk handkerchief, backed away to his pony, flung the Wells Fargo pouch of gold across his saddle bow, cut loose with a parting volley of bullets, and galloped off across the prairie trails to lead-pursuing posses through nights of hard and fruitless riding?

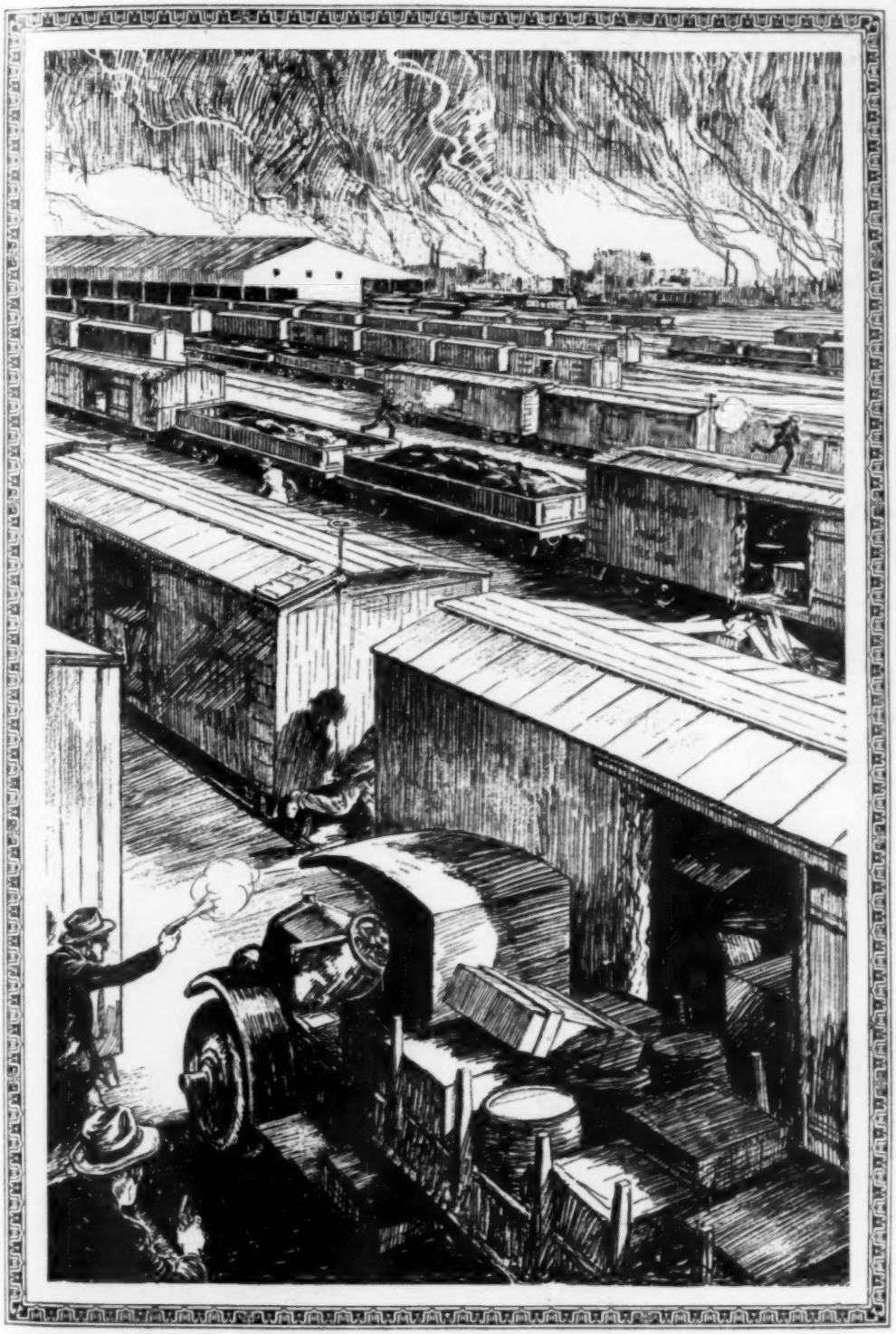
Gone? Not a bit of it! He has changed his game, that's all. He may have lost his picturesqueness—which any railroad detective will assert he possessed only in fiction—but he has simply turned to new paths in his hopeless struggle against law and order. His pony has been superseded by the automobile. Smooth concrete roads are his prairie trails of today. And his loot is carried away in carload lots by motor truck.

For the masked desperado of other days, a gunman still, has gone to robbing freight trains; not that it is less hazardous, but because it holds out a false lure of greater profit. At a recent meeting of railroad detectives in Chicago, one veteran estimated the railroads in Illinois alone lost approximately $10,000,000 in merchandise through freight car thefts in 1922. Other officials, however, say this figure is far too high and point out that the losses are constantly decreasing.

Freight Packages Broken Into and Looted by Thieves, the Contents Being Thrown Off Train

One of the greatest factors in cutting down the number of robberies is the railway police—or special agents, as they are better known. Through the organization of squads of "train riders," picked marksmen, armed with shotguns and rifles, who convoy valuable shipments, thievery is being made too costly to be profitable. Other rifle squads, riding in high powered motor cars, are nightly patrolling the highways that parallel the rights of way. Any of these men, if asked about the days when the Younger band and the Daltons made life miserable for trainmen and passengers in Missouri, will declare the depredations then were insignificant as compared to the problems the railroad police have to meet today.

It was the late William A. Pinkerton, the man most feared by train and bank robbers during the years they terrorized the west, who stripped the Missouri desperadoes of the halo of bravery and the garb of glamor bestowed upon them by the writers of lurid fiction. In an account of the operations of the principal holdup gangs between 1875



Running Pistol Battles with Thieves while Dodging Around Freight Cars in Dimly Lighted Terminals Add to the Thrills and Danger in the Lives of Railway Detectives

and 1907, he pictured them all as a lot of "cowardly assassins," and so they remain to this day.

Just as a crime wave swept along in the wake of the civil war, so the epidemic of train robberies followed the world war, according to the special agents. History repeats itself. At first the thefts were mostly of silk. Then special guards were placed aboard the trains and the number of these robberies declined. One such recent shipment was valued at $12,000,000. It was carried in forty-six cars and accompanied by twenty-five armed guards. Then prohibition came, and the thieves turned their attention to alcohol and liquor. This class of robbery reached the peak in 1920 and 1921. Now all these shipments are heavily guarded until they reach the consignee.

Gamblers Using Marked Cards on Crack Train Trapped by Detective

"There hasn't been a silk robbery in a long time now," said one veteran, "and we haven't lost a quart of alcohol in months."

Just after the war came a series of mail robberies in which the loot ran into millions. Most of these holdups were committed, however, either after the mail sacks had been thrown from the trains or were being carried to the depots. These thefts became so numerous the war department placed armed marines on all mail trains and also on the postal trucks. There hasn't been a big mail robbery since.

It used to be that most freight car thefts were committed in the yards at the large terminals, but these yards are now efficiently patrolled, 1,800 special police being assigned to duty in the yards of the Chicago district alone. The result is that the majority of robberies occur on the road while the trains are moving. How, the average person asks, can a whole freight car load of stuff be stolen while the train is going forty miles an hour? Listen to Chief J. Boyle of the Pullman Company's police force, and a member of many a posse that chased old-time train robbers across Missouri. He describes the modern method of operation as follows:

"The thieves are tipped off as to the number of the car and the kind of goods it contains. They hide on top of it and pry open the door after the train leaves the yards when the darkness hides the thieves from the train crew. The rumble of the wheels drowns out the sound as they begin throwing out the packing cases, cartons, barrels or boxes. The thefts always are committed where a highway parallels the tracks, where their confederates can pick up the loot with motor trucks."

To stop this practice, the roads are using shotgun crews in automobiles to patrol the highways near the tracks. Occasionally these squads come upon the thieves in the act of loading their trucks and the battle is on. The train riders usually ride in empty gondolas so they can watch both sides of the cars. Many a running battle over the lurching tops of box cars is fought between them and the thieving gangs, but the public seldom hears of the incident. A few lines in the newspaper announce that John Jones, a railroad detective, was found shot to death in the so-and-so yards, and that's the end of it.

"Talk about the James boys!" exclaimed L. J. Benson, chief of a force of nearly 3,000 detectives employed on the Chicago, Milwaukee & St. Paul system. "Some of these freight thieves have got them beaten forty ways. Get into a pistol argument with some of these birds dodging in and out among freight cars on a dark night and you'll get all the fun you're looking for.

And I have yet to hear of one of my men going the other way when under fire."

Another feature of the special agent's work is the protection of passengers on crack trains from swindlers and gamblers. For instance, a passenger on one of the fast limited trains running between New York and Chicago was approached by a stranger who asked if he played bridge. Responding in the negative, he was informed that but one other member was needed to complete the foursome and that, although bridge was their favorite game, pinochle would be played if he so desired. The passenger refused, but shortly after noticed a young man trailing the inquirer back to a compartment, and later return with a rather discontented look upon his countenance. The two struck up a conversation which ultimately drifted to gambling.

Overhearing the conversation, a gentleman, apparently an ordinary business man, joined in the discussion, and later solicited their co-operation in an endeavor to "get the goods on" the two card sharks who occupied the compartment. His credentials proved him to be a railroad detective. After dinner the special agent and one of the passengers adjourned to the club car to enjoy a quiet smoke and a social game of cards. It was not long before two men approached, and one, the individual who had extended the invitation to join his party for a game of bridge or pinochle, suggested that they go back to their compartment and have a little game.

This invitation was accepted, and as the detective started to shuffle the deck of cards with which he had been playing, one of the strangers suggested, "Let's get a brand new deck." He rang the porter's bell, and in a few minutes the game was on. As it progressed, the bids were raised and the winnings of the gamblers increased.

Departing in seemingly good faith, the victims sought the porter. The detective made known his identity, and a rapid succession of questions that form a part of every grilling caused the porter to admit that he had supplied marked cards. The confession was drawn up in writing, signed by the porter, and the two swindlers were arrested at the next stop.

Few people realize that they are purchasing personal property insurance, if it may be termed as such, when buying railway tickets. The detectives, however, also act as a guard against pickpockets and wearing apparel thieves. One tells of a passenger who had fastened a highly valued, diamond stickpin on the underside of his necktie which he, in turn, placed in the pocket of his trousers upon retiring. The next morning it was missing and later was recovered from a pawn dealer.

Assisting county authorities, the special agents also conduct investigations of the causes of the death or injury of employes, patrons and trespassers and help in the promotion of measures for public safety.

In the Chicago district the crossing watchmen on the Pennsylvania railroad help to gather data in a campaign to prevent careless driving by motorists.

One of the Great Railway Terminals Constantly Guarded by Detectives

GOLF COURSE ON ROOF HELPS PLAYERS TRY CLUBS

Laid out on the roof of a hardware establishment in a canyon formed by office buildings, a nine-hole golf course in Atlanta, Ga., is said to be of great aid to practicing players, and beginners. High wire screens prevent the balls from dropping into the street below, and putting is permitted only at half the holes. Where full swings are allowed, canvas walls stop the flights of the "pellets." Oiled sand is used for the "greens" to give a resiliency resembling that of grass. Instructors are available, and patrons of the store's golf department can test the various weights and "fits" of new clubs on the miniature fairways.

Roof-Top Golf Course where Players May Practice and Try Out New Clubs; Heavy Canvas Walls Retard the Flight of Balls when Full-Swing Strokes Are Permitted

TOBACCO SMOKE NOT HARMFUL ACCORDING TO MINE TEST

To test the effect of tobacco fumes, three men were confined in a closed chamber where the air was so smoky that it was impossible to see across the room. The atmosphere was so irritating to the eyes that it was necessary to wear goggles. After an hour and a half, samples of the air and the blood of the smokers were taken for analysis. The experiment was made by the bureau of mines, and, as a result, it was decided that the harm from smoking indoors, or in mines, is negligible.

EUCALYPTUS OIL RIVALS "GAS"

Refined eucalyptus oil is reported to have been found practical as a substitute for gasoline as fuel for engines. When a mixture of the fluid and gasoline, benzol, or alcohol is used, it is claimed that no carbon can form on the motor parts. Experiments recently made have shown that 25 gallons of the liquid can be extracted from 1,000 pounds of the eucalyptus leaves.

ALARM CLOCK FEEDS POULTRY AND TURNS ON LIGHTS

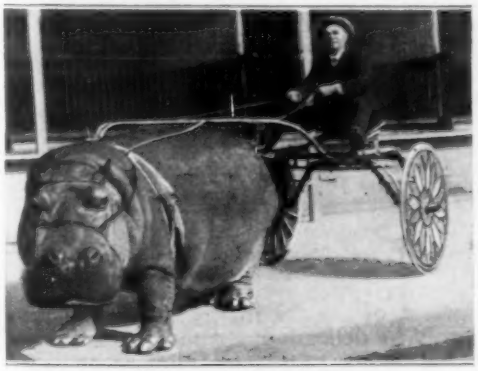
Poultry can be supplied with grain automatically at any desired time from a feeder operated by an alarm clock. The apparatus scatters the material in proper amounts over a 20-foot space, insuring the fowls sufficient exercise in gathering it. A switch attachment can also be made to turn electric lights on and off without interfering with the feeding mechanism. The device can be hung to the ceiling of a coop or placed over a yard, and is designed to do away with much of the care required from attendants. It is claimed that it can be filled and set for work in a few minutes.

BURIED CITIES OF HOLY LAND UNEARTHED BY AMERICANS

Five layers of earth, each of which contains traces of a separate civilization, one upon another, have been exposed by American excavations at Beth Shean, fifty miles north of Jerusalem. The hill where the digging is in progress overlooks the whole surrounding country, and from earliest times was used as a habitation and stronghold. Conqueror after conqueror planted his armies there. Past it runs the road where went all the travel from Syria and Mesopotamia to Egypt, following the River Jordan south toward Suez and the Nile. Relics already have been found of Arabic, Byzantine, Roman, Greek and Egyptian occupation. There also, it is believed, David, the psalm singer, vanquished the armies of Saul, and, in 1918, the Britons routed the Turkish forces.

CIRCUS "HIPPO" IS HARNESSED AND TRAINED TO DRAW CART

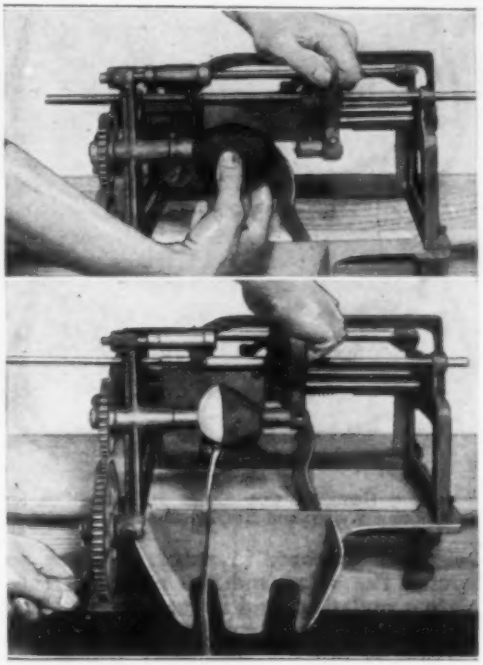
After considerable coaching at the hands of an animal trainer, "Lotus," a circus hippopotamus enjoying winter quarters in California, was taught to haul a two-wheeled cart. A V-shaped tongue attached to a broad band around the creature's back made traces unnecessary. A bridle of strong leather with the reins attached to the jaws completed the harness, and aided in directing the "river horse" which seemed to enjoy its "stunt" as it walked to its pool and back. Hippopotamuses are said usually to show little intelligence, but they are capable of great speed when in flight from an enemy, or while rushing to an attack after being wounded.



Giant "Hippo" Harnessed and Hitched to Circus Cart, About to Give Trainer a Ride

PEELER SHAVES THIN PARINGS FROM ROUGH VEGETABLES

Vegetables of irregular shape are pared evenly and quickly on an automatic peeler recently invented. The machine is so adjusted that as the spindle turns, a broad knife follows the contour of the vegetable regardless of its shape. The blade can be set for peelings of different thicknesses, and sharpens itself as the crank is turned. The device is safe, as the cutter is out of reach of the fingers. Vegetables are quickly put on the spindle or removed, and waste is prevented, as parings can be cut as thin as desired.



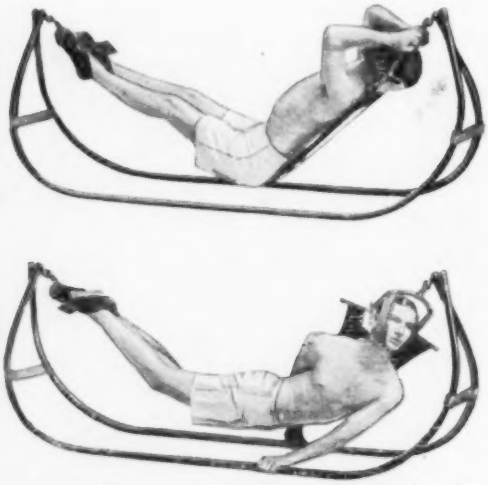
Automatic Peeler with Self-Sharpening Knife that Pares Vegetables Evenly as Spindles Revolve

WIRE SERVICE FOR DRAWINGS IS OPENED IN FRANCE

Plans, designs and manuscripts are being accepted by the French government telegraph and transmitted by wire between Lyons, Paris and Strasbourg. It is expected that eventually the letter system will be extended to all the larger cities. The patented devices used are said to be so perfect that a transmitted signature is valid. The cost is relatively small, depending on the dimensions of the manuscript or drawing.

EXERCISE IN HAMMOCK HELPS TO REDUCE WEIGHT

To exercise the parts of the body in which fat accumulates, and help users improve their physical condition, a revolving



Exercising Hammock that Serves as Gymnasium for Reducing Weight and Keeping Muscles in Order

hammock has been invented. It is said to stretch the spine and the muscles, stimulate circulation, and reduce weight. The device consists of a metal framework, with stirrups at one end and head grip at the other. A strap goes under the chin. Canvas webbing, shaped like a "Y", supports the body.

HORSE WILL BE ZOO CURIOSITY IN CENTURY, EXPERT SAYS

Due to the adoption of motor power, horses will become extinct in a hundred years, says a scientist of the University of California, now studying the subject. In spite of the fact that the number of the beasts is on the increase, a century will find them only as inmates of zoos in America, he says. For the purpose of preserving their forms for future students of animal life, the expert has started a collection of specimens of all kinds of horses. Even those types that have not, as a rule, been used as burden bearers are expected to pass away in this country.

BRIEF-CASE BUILT INTO GRIP

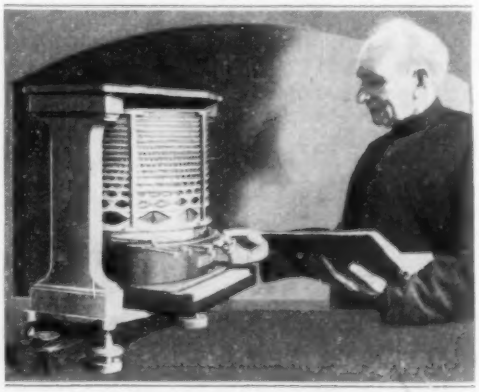
To save baggage space, a traveler's grip is being manufactured with a compartment that can be used as a brief-case. With it, wearing apparel and books and papers can be carried in one package, arranged so that any part of the case can be quickly reached. The container is strongly built of heavy leather and opens at the top in two sections, permitting a full view of the inside and allowing great freedom when extracting articles.

SAWDUST IS TURNED INTO WOOD

To be used as substitute for wood, a composition, containing about fifty per cent sawdust mixed with chalk and chemicals, which is then highly compressed into a solid mass, has been developed by a European scientist, it is reported. The finished substance is declared to answer all construction requirements of timber, and to be as hard as oak, though not subject to decay, and combustible only at very high temperature.

SOUNDS OF "SIREN" MEASURE SPEED OF THE WIND

For measuring the velocity of wind, Abbe Rousselot, of the College of France, has invented a machine that indicates the speed by sounds it gives off when air passes through openings in an upright cylinder. Buttons at the base release sixteen different sets of vents, which by the pitch of their notes, determine what rate of air motion is causing the tones. Devel-



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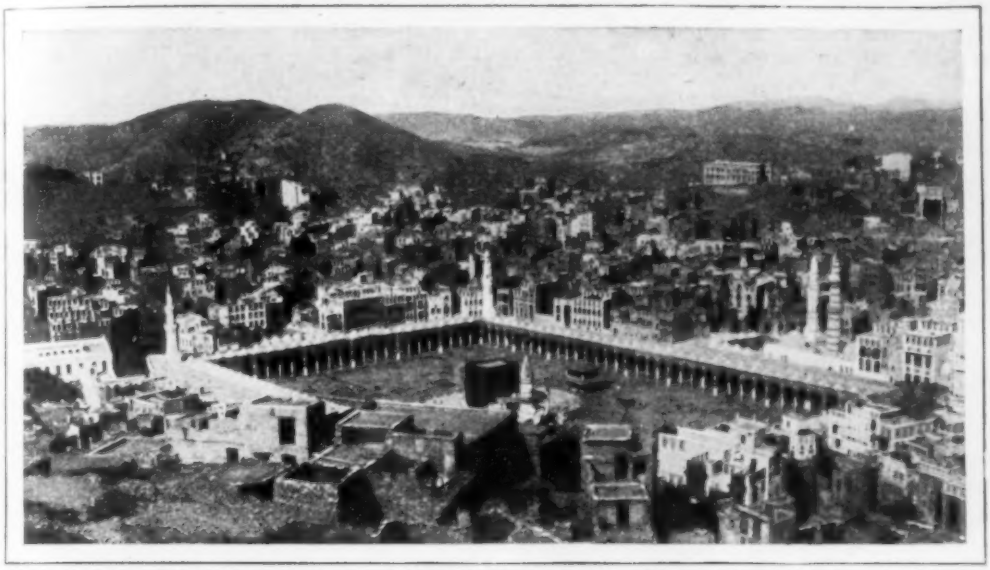
Instrument that Tells Speed of Wind by Giving Forth Sounds Caused by Motion of Air

opment of the "siren," it is believed may result in delicate instruments to inform aerial experts of the condition of the upper strata before taking flights in aircraft.

¶A can of crushed coke placed in an ice box or basement is highly effective in absorbing unpleasant odors.

SACRED CITIES TO BE LINKED BY RAIL AND WIRE



General View of Mecca, One of the Sacred Cities, Noted for Its Great Mosque with Its Spacious Courtyard, which Every Moslem Is Expected to Visit at Least Once

Mecca and Lhasa, the sacred cities of the Moslems and the Buddhists, may soon break through the isolation of centuries, a native syndicate having been formed to finance a railway between Medina, the burial place of the prophet, Mohammed, and Mecca, the city of his birth. There are, of course, other so-called sacred cities, such as Kerbela in Mesopotamia, and Meshed, in Persia. While it was possible for a Christian to enter the last named, and even to penetrate into Kerbela, provided he was accompanied by a Moslem guide, until comparatively recently on no consideration were they allowed to approach Mecca or Medina, while, up to the present, Lhasa has also been, in reality, a closed city. Not very many Europeans have made safe journeys to the sacred cities. Mecca lies in a valley some 70 miles from Jedda, a port on the Red Sea, and 248 miles from Medina, and the construction of a railway between these two points will prove difficult, as the country is rough, barren, and mountainous. Another sign that the traditions of ages are breaking down is seen in the action of the Grand Lama of Lhasa, the headquarters of the Buddhists, in Tibet, in ordering that his capital be connected with India by telephone. Lhasa is situated in a lonely valley, surrounded by tall mountains, and is dominated by Potala Hill, on which stands a single huge edifice where dwell thousands of red-robed monks. In the center of the city is the Jokang, the most sacred temple in all Lhasa, for there is housed the most famous idol in the world, an immense statue of Buddha. It is said to be a faithful image of the great teacher. He is shown in a darkened recess of the cathedral illuminated by innumerable butter lamps and having for his companions two great gilded idols of other gods. It wears a crown of gold set with precious stones, while across its breast are many necklaces of gold, also set with jewels.

RADIO BEACON GIVES FLIERS THEIR BEARINGS IN FOG

Set up at a fixed location, a radio beacon to guide airmen in cross-country flights, and to aid naval aviators in finding their bases, has been tested. Fog and darkness will have little effect upon its usefulness. The instrument rotates to the right, and flashes signals every five seconds, the distance between any two impulses which follow each other being 30 degrees. Starting at the north, which is zero, a distinctive code signal, say, for example, two dots, is sent out. The flier, who has picked up the station, waits for the initial flash, and then, with his watch in hand, counts those which come after until he hears both dots with equal intensity. This gives him his compass bearing for landing.

LADDER ON AUTO BUS UNFOLDS TO REACH BAGGAGE RACK

To make easier the placing of luggage on its roof, an automobile bus has been

Folding Ladder on Auto Bus that Permits Easy Loading of Luggage on Roof of Car

made with a light, metal ladder that is hinged in the middle, attached to the body. The contrivance can be unfolded so that its lower end will rest on the ground. This arrangement is said to leave more room for the comfort of the passengers, since cumbersome bundles do not need to be held on the seats or placed on the floor. Absence of such obstructions saves time at stops as patrons can enter and disembark quickly.

DIVERS BRING FRESH WATER FROM UNDERSEAS SPRINGS

Scarcity of accessible wells and seasons of drought compel men in various parts of the world to risk life and limb and engage in laborious toil to get their supplies of fresh water. Before artesian wells were drilled, native divers at Basra, on the Persian Gulf, swam to the bottom of the shallows and obtained drinking water by inverting skins over the upward column that flowed from a sweet, submarine spring. In the mountains of Morocco, a cavern in an extinct volcano has long supplied residents of an upland village. Natives of northern Yucatan get much of their water from subterranean pools discovered ages ago by the Mayas in deep gorges and chasms of the region. Men creep along perilous ledges, and descend rudely made ladders leading from one level to another, on their trips, with calabash gourds for carrying the precious liquid swung below the hips on thongs wound about the forehead. Torches are required to light the way along the dark paths, and near one ruined city of the peninsula, from the evidence of smoke-stained walls and foot-worn rocks that lead to a chasm well, scientists declare that the cavern was visited by water-carriers at a time when Thebes was a flourishing city and Tutankhamen was king.

POWER-DRIVEN SCREWDRIVER ALSO WILL SET NUTS

For driving or extracting screws and setting or removing nuts, an attachment fixed to a motor-operated flexible shaft has been designed. It is of special advantage when used to reach spots that are difficult for the hand tool, and can accomplish its work in a fraction of the time required with ordinary utensils. The appliance can be stopped without shutting off the motor by turning a release clutch near the handle. Two grips are provided so that sufficient pressure can be put upon the point from almost any position. The parts for the different tasks can be interchanged in a

Motor-Operated Screwdriver and Nut Setter that Does Fast Work in Difficult Positions

few moments. A light-weight iron stand on rollers supports the machine.

¶Blowing red-hot rivets through a tube is displacing the old and dangerous method of throwing them from the forge to the workman on steel structures.

Bit of Badly Charred Paper — As It Looked After Treatment

Ash Piles Are Made to Yield Millions

Blackened Sheets of Carbon, Representing Fortune in Currency and Bonds Are Restored through Photo-Chemical Process

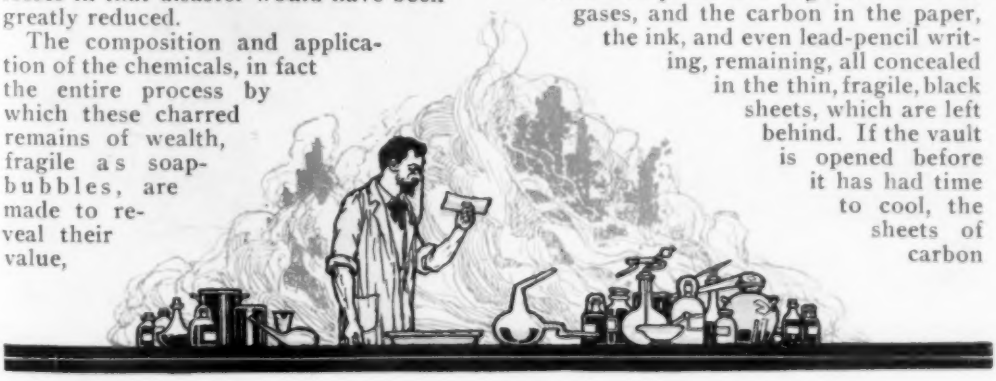
By H. H. DUNN

THOUGH science has not yet succeeded in preventing conflagrations by which whole cities are destroyed, chemistry and photography hand in hand, have just come forward with a revelation whereby burned documents can be restored and redeemed.

By this discovery more than half a million dollars worth of currency, stocks and bonds were saved from the ashes of a fire at Astoria, Ore. By it millions more will be saved from the ruins of Tokyo and other Japanese cities. Had it been known when the scientists uncovered Pompeii, the vast libraries of that lava-scarred city could have been rescued. If men had discovered the proper combination of chemicals and the correct use of the camera, millions of dollars worth of papers and currency would have been redeemed from the San Francisco fire of 1906, and the losses in that disaster would have been greatly reduced.

The composition and application of the chemicals, in fact the entire process by which these charred remains of wealth, fragile as soap-bubbles, are made to reveal their value, their character and, what is more valuable still, their recorded numbers, was discovered only a few months ago by Dr. Edward O. Heinrich, lecturer on criminology and criminal investigation in the University of California. He was led to it through work with chemicals in the hunting down of erasures and alterations in the forgery of checks, wills, deeds, titles and "raised" paper currency. From the same source, he brought the eye of the camera to bear on the subject, even calling upon the microscope to assist.

The process is based on the fact that documents, i. e., paper of all kinds, are not burned when tremendous heat is applied for a long time to the exterior of a bank vault or other supposedly fireproof receptacle. Instead, the paper is destructively distilled, the hydrogen or other components being driven off as gases, and the carbon in the paper, the ink, and even lead-pencil writing, remaining, all concealed in the thin, fragile, black sheets, which are left behind. If the vault is opened before it has had time to cool, the sheets of carbon



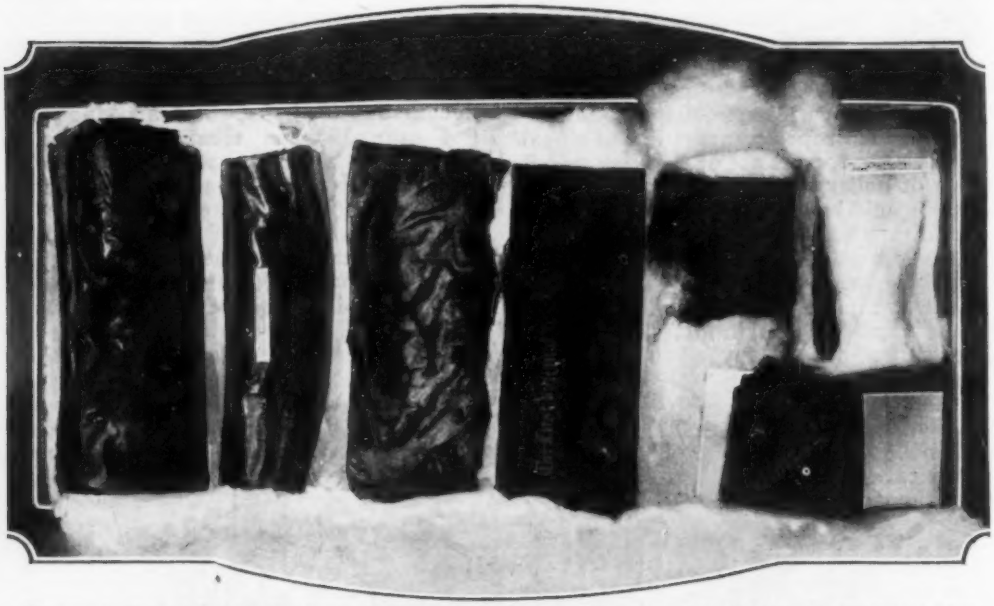
burst into flame and are destroyed, or reduced to such flimsy ash that they cannot be saved. If, however, the vault is allowed to cool every document in it can be saved.

The method used by Dr. Heinrich was first applied to the contents of the vaults of the Astoria National Bank and the Columbia Trust and Savings Bank, in Astoria. The sheets of carbon are put into a tray of chemical. This solution strengthens and slightly glazes the sheet of carbon, and brings out the lines left by the mineral in the ink of the writing or printing, and the graphite in the penciled script. The majority of the papers then can be read with the unaided eye, but in complicated cases, such as wrinkled papers, very thin sheets, or those on which weak ink has been used, it is necessary to call in either the enlarging camera or the photo-microscopic instrument, which brings the writing or printing up to such size that it may be read on the photographic plate.

"Deciphering of the printing and writing on these sheets is a question of the ability of the eye of the operator to distinguish shades of black," says Dr. Heinrich. "Straw paper, for example, gives a brown-black ash, while the iron inks, usually used in writing and printing, give a dead-black. Pure linen paper, however, also gives dead-black ash, and the only way in which the writing and printing on it can be deciphered is by tilting the sheet at all angles until the one at which the lettering appears is reached. The cheap pulp papers give a gray-black, on which the coal-black of ink is even more easily seen. Lead-pencil writing, after passing through fire, gives a silvery gray line, comparatively easy to read, provided that the writing was legible in the first place.

"In working with the documents left from the Astoria conflagration I made an interesting discovery—that, by wetting my finger on my lips and applying the saliva to the sheet of carbon, I could very frequently change either the color of the paper or the color of the ink sufficiently to be able to read the lines written on the former. Another interesting fact which came out at the Astoria fire was that plain Manila envelopes, of good quality, are the best containers for valuables. Leather pouches, in which currency and documents are kept, most frequently boil up like milk when subjected to heat, and so gum up the papers that it is almost impossible to separate them."

Diamonds, rubies and sapphires stood up well under the heat and were restored to good condition when cleaned with the chemical. Pearls, opals and corals, however were so badly cracked and their luster so dimmed as to render them virtually valueless. Gold and silver coins, of course, melted and were rescued as bullion. Documents such as deeds, transfers of title, marriage licenses, and divorce decrees, all of which had been recorded, were thrown away when the numbers were obtained.



Fortune in Burned Stocks, Bonds, and Certificates Restored by Chemical and Photographic Treatment after Having Been Reduced to Bits of Blackened Carbon

SOLDIERS TURN ACTORS TO DRIVE WAR CHARIOTS

Squadron of United States Cavalry Horses and Troopers in Gilded Chariots Dashing Across Sandy Plain to Depict an Egyptian Battle Scene for the Motion-Picture Camera

United States cavalrymen took the role of Egyptian warriors in a motion-picture production a short time ago, and, in elaborately decorated chariots, swept across a sandy plain. The vehicles were fashioned closely after those of antiquity, with no springs or seats, open at the rear so the warrior could leap in or out with ease, and large enough for only the fighter and his charioteer, who did the driving. Quivers full of arrows, and rich ornaments identified the chariots of the Egyptians.

SHIELD ENDS SPOTLIGHT GLARE TO AVERT AUTO WRECKS

Spotlight rays that usually are projected upward and are lost, or confuse other motorists and pedestrians, are focused directly upon the road by a lamp of recent design, which has silvered reflectors and two lenses, so adjusted that dangerous glare is removed. A top shield effectually projects the full radiance of the light upon the roadway, allowing persons approaching the car to see it clearly.

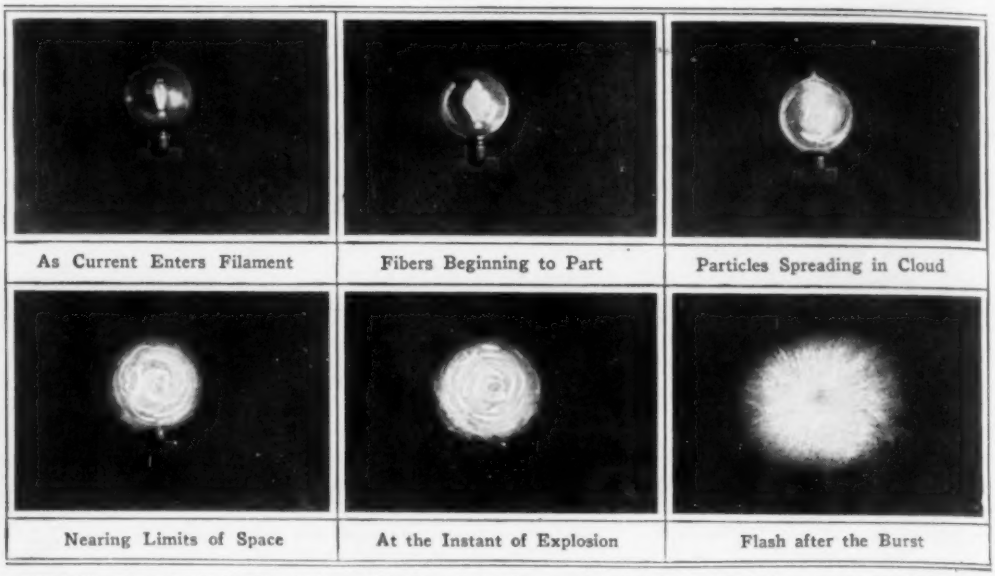
OVER THOUSAND COLORS LISTED

Colors of every tone and shade, to the number of 1,400, are displayed in an index recently issued. There are no duplicates in the list, which was compiled from the productions of dye makers all over the world. Many scores seem exactly alike to the eye, but tests show that they are not. America sent samples from twenty-nine factories, while England and Germany were each represented by thirty-two.

FLOORS ON FELT-LINED "CHAIRS" MAKE ROOMS SOUNDPROOF

To make rooms proof against outside noises, floors, ceilings and partitions placed upon chair-shaped, felt-lined supports are isolated from surrounding surfaces, and no vibrations can be communicated to them. Soundproofing by the common use of layers of felt or other material, has been found largely ineffective as vibrations are readily communicated by nails driven through the insulation. The "chairs" completely cut rooms off from outside noises by separating the sides from those adjoining. An absorbing blanket of cinders fills the space between and under the nailing strips and insures added quiet. The cushions also give resiliency to dance floors, bowling alleys and gymnasiums, and their use has been found of special benefit in the construction of hotels and large office buildings where noisy machinery is installed in rooms above those occupied by guests or workers.

CAMERA TAKES TWO THOUSAND PHOTOS A SECOND

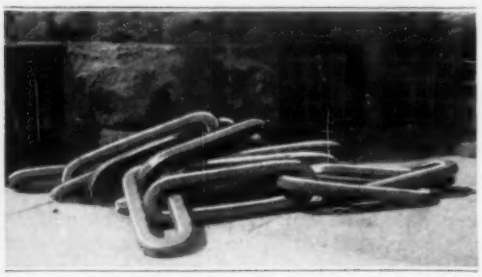

As Current Enters Filament
Fibers Beginning to Part
Particles Spreading in Cloud
Nearing Limits of Space
At the Instant of Explosion
Flash after the Burst

With Unerring Truth the Speed Camera Registered the Stages of Action in the Explosion of an Electric-Light Bulb that Was Subjected to an Overcharge of Current

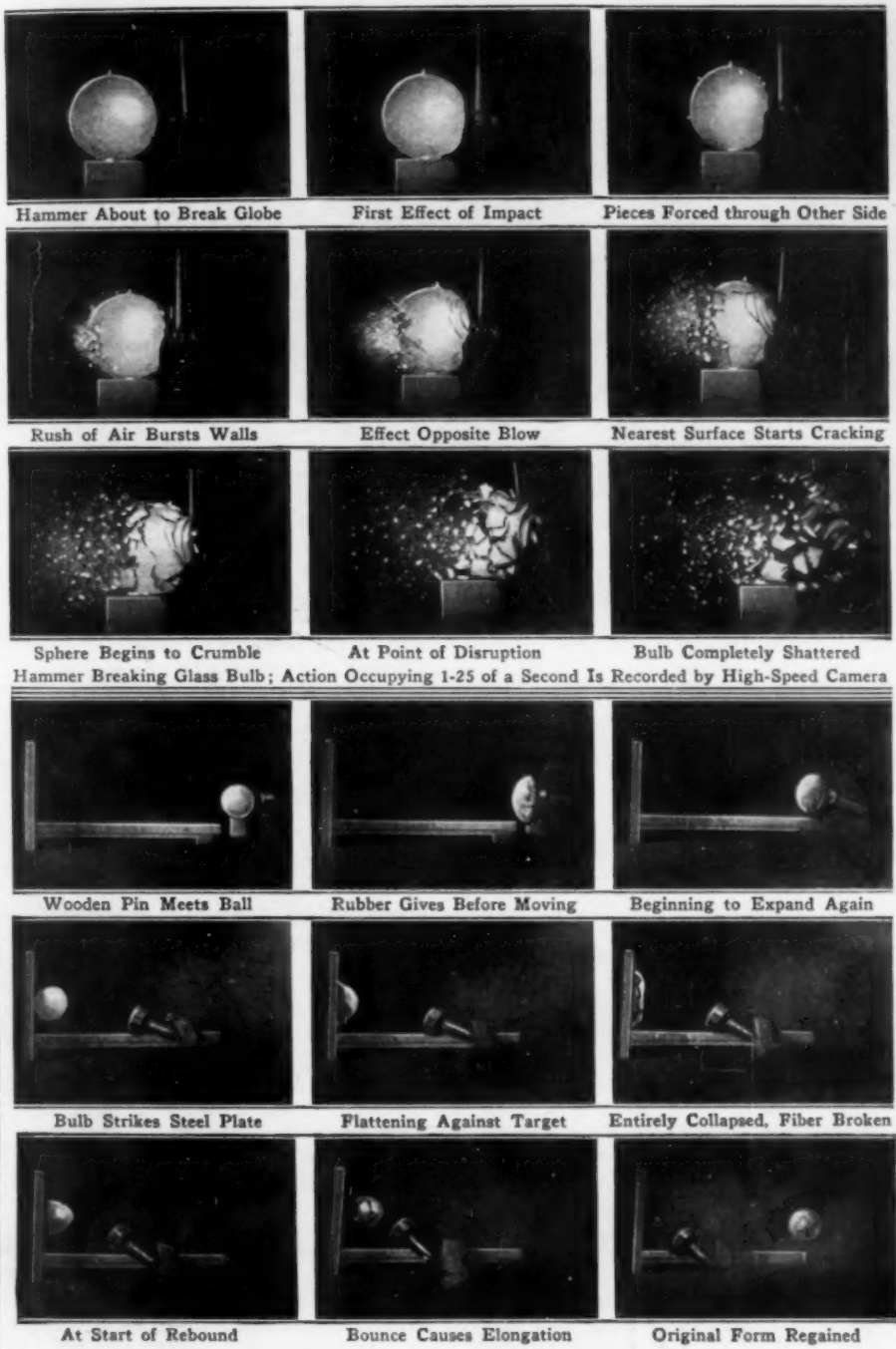
With a motion-picture machine capable of taking pictures at the rate of 2,500 a second or 900,000 an hour, experimenters recently obtained unusual photographs of the breaking of a glass vacuum globe by the impact of a small hammer. Probably the most interesting fact recorded by the camera was that the side of the bulb opposite the hammer was first perforated by minute particles of glass hurled against it by the inrush of air as it entered where the tool had struck. Owing to subsequent cracking on the globe, those small breaks grew larger and through them a cloud of fine powdered glass emerged. Between the picture showing the instant of impact and that of the bulb in almost total collapse, there was an interval of a very small fraction of a second. Only $\frac{1}{25}$ of a second was occupied in recording the entire experiment, from the time the hammer neared the bulb until it was nothing more than a pile of finely broken glass the result of the impact of the blow.

GIANT CHAIN OF REVOLUTION DEFIES TIME AND RUST

Although they were submerged in the Hudson River for five years, and have been exposed to the weather since the days of the Revolutionary war, iron links in the famous Putnam chain that helped keep the enemy from reaching inland forts, show little sign of rust. Several of them have been on exhibit for more than two years in front of the Chicago Historical Society's building, but rains and snows have had practically no effect on them. Hand-forged from ore dug in mines near Sterling, N. Y., the huge chain, 500 yards long and weighing 186 tons, was floated on rafts and logs just beneath the surface of the water in six weeks after General Putnam had issued the order for its construction. One hundred and eighty-two men worked at the task of forging and smelting the ore. Though only hand tools were available, the links, some of them more than three and one-half feet long, were symmetrically and perfectly welded.

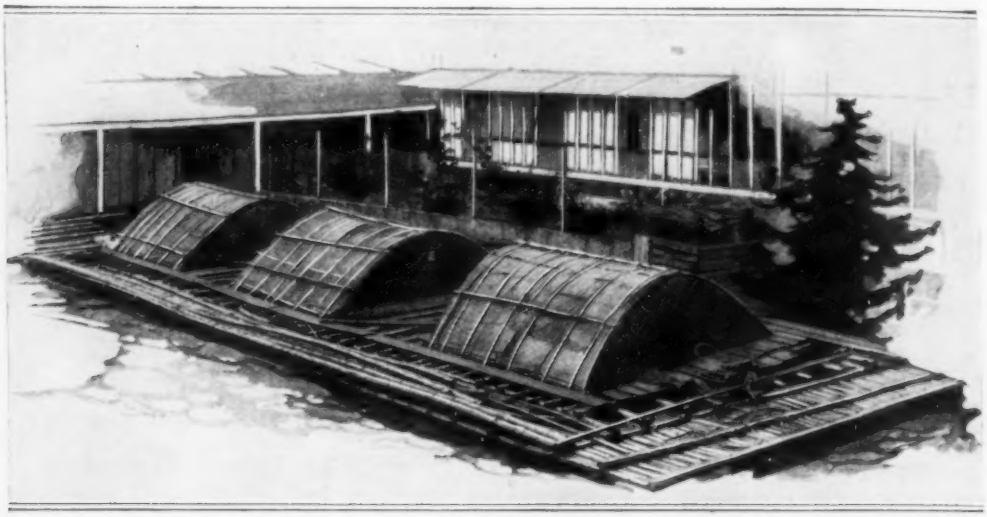


Great Chain Made During the Revolutionary War that Has Defied Time and Weather


Hammer About to Break Globe
First Effect of Impact
Pieces Forced through Other Side
Rush of Air Bursts Walls
Effect Opposite Blow
Nearest Surface Starts Cracking
Sphere Begins to Crumble
At Point of Disruption
Bulb Completely Shattered
Hammer Breaking Glass Bulb; Action Occupying 1-25 of a Second Is Recorded by High-Speed Camera
Wooden Pin Meets Ball
Rubber Gives Before Moving
Beginning to Expand Again
Bulb Strikes Steel Plate
Flattening Against Target
Entirely Collapsed, Fiber Broken
At Start of Rebound
Bounce Causes Elongation
Original Form Regained

Movements of Rubber Ball Shot at Steel Plate Are too Slow for Super-Rapid Photography

MODERN ARK IS BUILT TO ESCAPE TIDAL WAVE

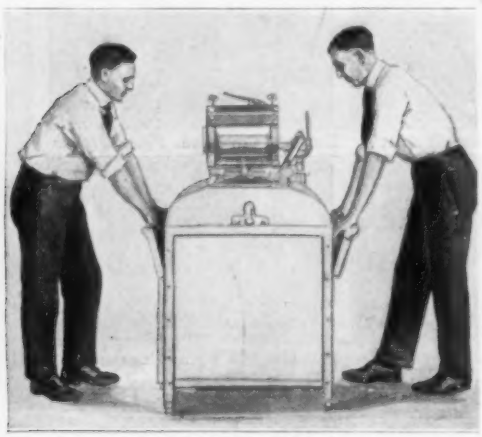


Bamboo "Ark" Built by Chinese Family as Refuge in Case of Tidal Wave

Fearing that the tidal wave that swept Yokohama also would destroy the city of Iloilo in the Philippine Islands, Chinese residents there hastily constructed a raft of bamboo and were prepared to flee to it if the inundation occurred. The rude craft was 84 feet long and 33 feet wide, and in three hutlike cabins were stored provisions for several days, and bolo knives with which the owners expected to fight off anyone else seeking to climb aboard. The feared inundation did not take place.

ELECTRIC WASHER IN CABINET IS SAFE AND ATTRACTIVE

Safe in operation and attractive in appearance, an electric washing machine has been designed in which all the gears and working parts are inclosed in a steel cabinet with hinged doors which permit easy access to them but lessen the danger of clothing catching in the wheels. The tub is constructed of insulated copper and will keep water near the boiling point for approximately five hours. Oscillations allow eight distinct movements of the water.



Washing Machine with Parts Inclosed in Cabinet to Promote Safety and Add Attractiveness

SECRETS OF THE SEVEN SEAS TOLD BY "BOTTLE PAPERS"

To learn the speed and direction of ocean currents, government experts use "bottle papers." Accurate knowledge of these drifts is important to navigation, and the safety of hundreds may depend upon it. Small slips, with directions for their return printed in the principal languages, are given to ship captains, to be sealed in flasks and thrown overboard. Months or years later, some return. One floated nearly across the Atlantic and back, and another crossed the widest part of the Pacific in a little over two years. A third, dropped near the Cape of Good Hope, was picked up on the western coast of Australia.

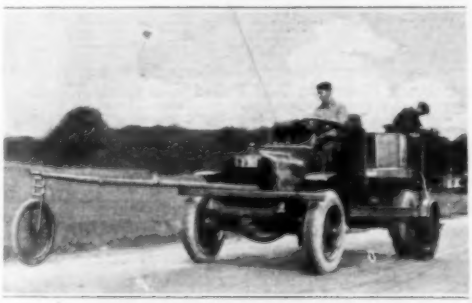
¶Engineers are planning a concrete tower 1,200 feet high to be used as a wireless station.

SEEDS BURIED FIVE CENTURIES BURST INTO GROWTH

Discovered under layers of peat at the edges of the Gobi desert in Manchuria, lotus seeds, believed to have been buried more than five hundred years ago, were made to grow in the laboratory at an eastern university. They attracted the attention of a Japanese professor, who saw children digging them out of the ground and eating them. The layers of peat, in places fifteen feet deep, protected the seeds from injury and decay. The spot where they were found is supposed to have once been a pond into which they fell from the trees that grew along the banks

TRAFFIC MARKER FOR STREETS BUILT OF WAR JUNK

Condemned war materials were made over into a traffic marker to run a line down the center of the pavement in Minnesota recently. These marks reduce the danger of accidents. An overhauled truck was fitted with a fifth or marking wheel with a solid tire, taken from another vehicle. The rubber was cut down to four inches in



Traffic Marker, Made from Condemned War Materials, Used to Help Prevent Accidents in Minnesota

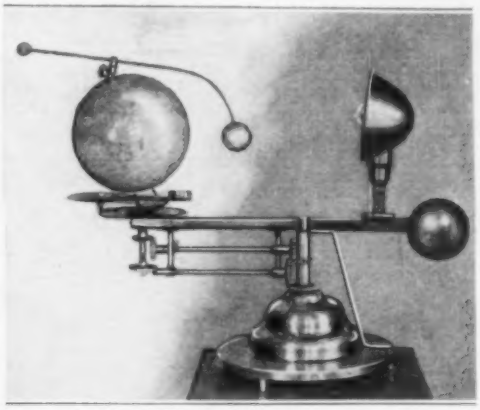
width, and paint was piped from a tank to drip upon it. Speed of operation was about 20 miles an hour.

WORLD EVENTS ARE SCREENED FROM PAGES OF MAGAZINE

Clippings and illustrations from Popular Mechanics Magazine were flashed on the screen by means of a reflecting device before members of the Young Men's Christian Association of Riga, Latvia, recently. Lively interest was manifested by the spectators in the pictures of time and labor-saving inventions, remarkable facts and occurrences of note gathered from all over the world by the publication.

ACTION OF PLANETS IS SHOWN BY MOTOR-DRIVEN GLOBES

To illustrate the workings of the solar system, the various seasons, night and day, and the different phases of the moon, a



Automatic Globes that Show Movements of Earth and Sun and Illustrate the Seasons

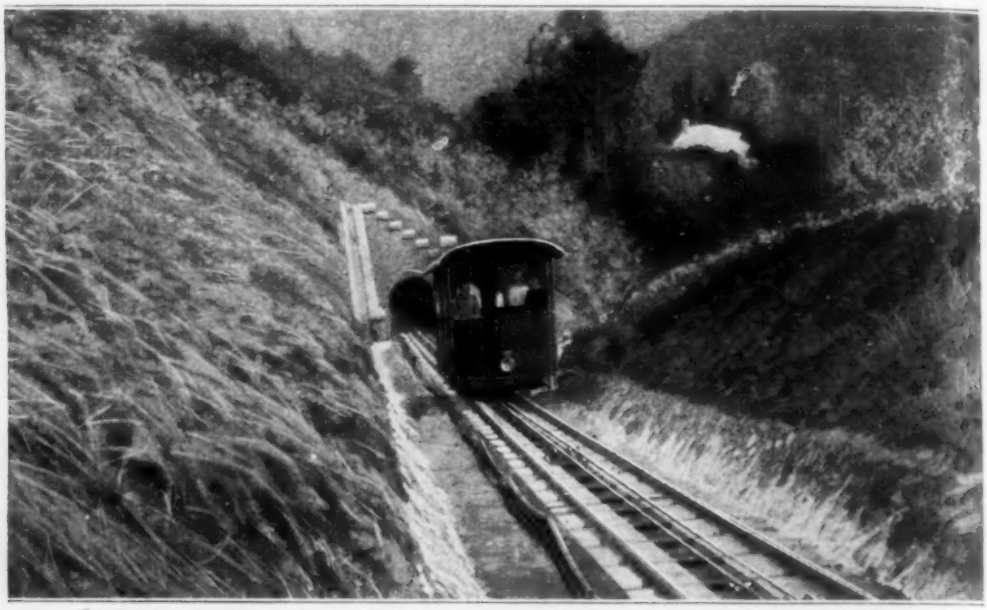
device has been patented which consists of several globes, among them one representing the earth, and another the sun. These are revolved by an electric motor and a system of gears. An electric lamp illuminates the "sun," the rays lighting half of the other spheres as they travel about in their orbit. Thus the hands of the demonstrator are left free to point out different phases of the action.

BUTTON ON STEERING WHEEL DIMS AUTO LIGHTS

So the motorist can without reaching to the instrument board, dim his headlights while driving at night, a button has been made that can be operated by a slight pressure of the finger without lifting the hand or releasing the grip on the steering wheel. The wiring from the switch to the lamps is so simple that it can be adjusted by almost anyone without the aid of a mechanic. It is believed that the use of the dimmer will help to avoid risk of accidents which might occur while the motorist is manipulating a control button located elsewhere in the car as he need not leave an erect position or take his gaze from the road ahead.

CABLE CAR WITH STEP-UP SEATS CLIMBS MOUNTAIN

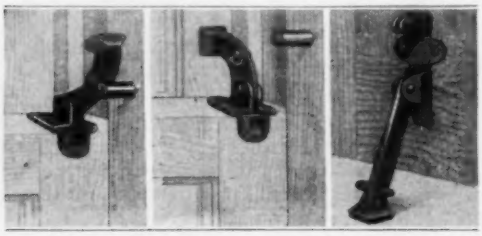
Running over a track that, in its total length of 1¼ miles, rises 2,070 feet above the sea, a railroad in Malaya carries passengers to the heights in 24 minutes. This feat has opened up residential sites which will relieve white men of many of the ills they suffer in the tropics, at low altitudes. The rugged formation of the slopes made necessary cuts and viaducts with a combined length of over ½ a mile. Owing to the fury of storms, the roadbed is constructed upon concrete and granite, and long bolts anchor the rails to the masonry. The cars carry 40 passengers each, and are built in step formation, one compartment above another, to conform to the grade of the track. They are equipped with brakes that act upon the rails like pincers. A cable connects the two cars to the drum of a powerful stationary engine; one car goes up while the other descends. Before reaching the summit, the right of way passes through one of the steepest tunnels in the world.



Climbing Out of a Steep Tunnel, this Step-Seated Car Ascends the Mountain Side Pulled by a Cable Winding on Drum at the Summit of the Grade

AUTOMATIC LOCK FOR WINDOW TO FOIL INTRUDER

Automatically locking when closed, a window appliance recently marketed can be fitted to almost any kind of sash. As the frame goes into place, the device adjusts itself to prevent the window's being opened from the outside. It also permits the window to be fastened in any position, and can be easily put on. A similar attachment for doors also is being made.



Lock Automatically Secures Windows when Sash Is Pulled Down, and Door Stop, at Right

OIL TO PROTECT RAIL TRACKS

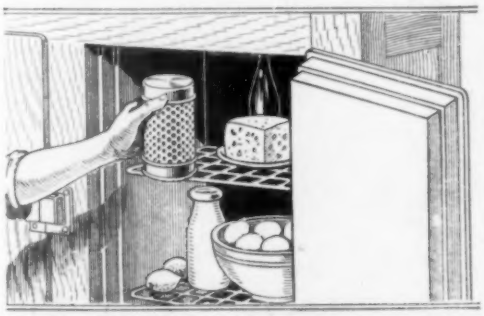
To stop rust on railroad tracks and make the steel fixtures last as long as the chemically treated ties, an eastern road has worked out a plan of oiling its rails, track bolts, tie plates, and other fittings of like character. The cost of putting on this coating is not high, and the saving effected on any one item of the track structure is said to justify the practice.

FLYING BOAT IS KEPT STEADY WITH UNDERWATER WINGS

So that a seaplane may alight upon rough water safely, and to prevent dangerous rolling, a boat bottom has been designed with stabilizing planes below the water line. These wings slope upwards and outwards, so that when the craft heels over, the immersion is progressive, and is therefore increasingly resisted by the water, thus tending to keep the craft upright. As hydroplanes are usually top-heavy, and offer a big surface to the wind, great difficulty has been encountered in protecting them from waves. For this reason, floats or boat hulls have been made very stout and strong, qualities not usually obtained when extreme lightness is desired. By decreasing the weight, it is hoped that the hull fitted with underwater wings also will aid the seaplane in rising.

"CHEMICAL SPONGE" TAKES ODOR FROM CLOSED COMPARTMENTS

To absorb food odors and gases frequently found in refrigerators and pantries, a "chemical sponge" has been made that occupies no more space than a teacup. Placed in a laundry closet or in a trunk, it will take up moisture and prevent damp odors from saturating the clothing. Surrounding the container is a perforated metal jacket which protects the interior and permits the passage of air to the solution. The deodorizer will last for several months, is harmless and its presence cannot affect the most delicate foodstuffs.



Absorbent Deodorizer in Perforated Container that Occupies Small Space in Refrigerator or Closet

¶There are now 145,000 radio sets on the farms throughout the country, which receive crop reports from 150 government wireless stations, according to recent estimates.

"COAL BIN" FOR LOCOMOTIVES LOADS TWO CARS AT ONCE

Coaling railroad engines is now being done through a massive hopper capable of feeding two locomotives at the same time.

Coal Hopper with Two Chutes that Make Possible Loading Two Tenders at Once

Stationed beneath a chute, the tender is fed with the fuel from a huge chamber having a capacity of hundreds of tons. Two large tubes make possible the double operation. The loading station, which is constructed directly over the tracks, is said to perform its work rapidly and without the usual wastage of coal.

MANY NEW USES FOR PAPER LOWERING SUPPLIES

Recently discovered uses for paper are yearly making greater inroads on available supplies, and, with the production in the United States decreasing, a substitute is considered a growing necessity. The production of all grades in this country for 1921 was 5,356,317 short tons, as compared to 7,334,614 short tons in 1920. Flexible and durable garments are now manufactured from paper from the mulberry tree. Paper cooking bags, bottles, grain sacks, and horseshoes have been on the markets for some time.

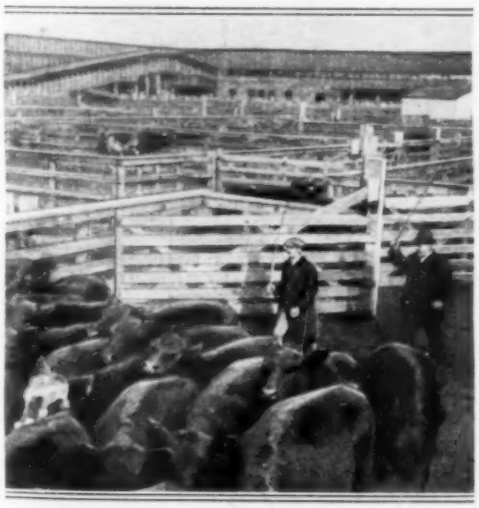
With a Gay Bandanna Around His Neck, the Modern Cowboy Presents as Vivid a Picture in Boots and Spurs as the Old-Time "Puncher," and Is Just as Skillful

Back O' the Yards Where Wild West is Still Seen Every Day

WITH the cutting up of the great ranges, the vivid cowboy with his wide sombrero, gay bandanna, chaps and spurs is fast fading into a dim shadow on the flickering screen of movieland.

Surrounded by towering buildings, clanking switch engines and a wilderness of tracks, the never-old drama of the wild west also is vanishing from one of its last strongholds—the Chicago stockyards.

Cattle still pour into Packingtown from their peaceful homes on the Texas plains or the prairies of Kansas or Oklahoma, but gone is the time when the 500-acres of pens represented a live part of a far-flung frontier.



Cattle Being Herded into Pens at the "Yards" after Their Arrival from Western Ranges

Cowboys are still to be seen in and "back-o'-the-yards," but they are city cowboys, although they can ride a horse just as well as the old timers who used to accompany the cattle to market. Nowadays, the railways feed, water, and exercise the animals so that the shipper does not have to send his cowboys with them. On arrival they are herded into pens by men who, in most cases, have grown up in the district, but who can rope a steer with as much skill as their brothers of the plains.

With the arrival of the cattle, there is a bustle of activity. Bulls bellow, horses neigh, and men shout. Whips crack as the cowboys prod on a lazy or bewildered animal. Here is where the arts and tricks of the cowboys are most needed, for if a cow or bull starts running and gets mixed up with another herd, the whole drove would attempt to follow, resulting in endless confusion. Often, as the animals are being taken from one pen to another, a steer will break loose.

"Close the doors!" is the shout then.

"Go get 'im, kid!" one of the riders will whisper to his horse, and the animal is down the alley after the fugitive like a flash. When he is within fair distance, the rider twirls a rope and lets it out with a long fling, and it settles over the bull's neck as neatly as though there was no other place where it possibly could fall.

The horse has been through similar incidents many times before and springs back sharply on its haunches when the bull is lassoed. The force of its sudden halt brings the animal to the ground, and a moment later a sadder but a wiser member of the bovine family is being chaperoned back to its playmates. The thing is done as well as though it was one of a hundred similar occurrences at a round-

up on the Miller Brothers' 101 ranch, down at Marland, Okla.

These city cowboys are as proud of their mounts as the "punchers" of the old days ever were and they take as good care of them. Some of their horses cost $350 or more, while the rest of them are bound to hit the mark somewhere between $100 and $250. The saddles are matters of as much care to the horsemen, too. A person who rides a great deal always takes an intense pride in his horse and its equipment, just as an experienced motor car driver likes to see his machine looking its best.

"Stunt" Riders at Rodeo

The horses are highly trained. They know their work and they do it with a business-like sincerity. If their rider is herding a drove of cows along an alley or from one pen to another, the horse will see that the animals keep walking straight along on their paths. When a gate bars the way, the horse will go up to it and turn sideways, so the rider can unlatch the barrier without dismounting. When the gate is opened, the horse walks through, then turns sideways to it again, so it can be closed. The horses on hay wagons can open and close many of the gates themselves by a nudge of the nose.

After the cattle have been sorted into the pens they are inspected by the buyers, of whom there are 300 or 400, all mounted on horses. These men make their bids dependent on market conditions and thousands of dollars will change hands without the signing of a single paper. "Weigh 'em to Swift," one will say of a $10,000 lot before the scale ticket is made out. From the pens to the coolers where the meat is chilled, takes exactly thirty-five minutes. That is all the time required to transform a steer from a living animal into human food.

With the shipments to the stockyards totaling approximately 16,000,000 head a year, so efficient is the process of dressing and so expert are the workmen, that the capacity of a single department in one of the larger plants is 250 cattle per hour. So perfect is the way of handling bacon, for instance, that it is sliced, weighed and packed in cartons without being touched by hand. All of the coolers where fresh meat is handled are maintained at an even low temperature by circulating very cold brine

through pipes suspended from the ceiling or wall. More than 3,000 sides of beef can be stored in one of the coolers where the temperature is kept several degrees above freezing, which chills, but does not freeze the meat. In addition to its own refrigerating apparatus, one of the big plants uses 250,000 tons of natural ice a year, principally in the cooling tanks of freight cars.

Over two-thirds of the beef that supplies the nation with food is raised in the west, but most of it is eaten in the east. About thirty per cent of every animal is waste, 1,000 pounds on the hoof producing only 550 pounds of meat, but little is allowed to go to waste. Even the fine hair in the ears of steers is cut and made into camel's hair brushes. It takes the hair from the ears of twenty-five steers to produce one pound. Another very valuable by-product is soap, a combination of fats, vegetable oil and caustic. In manufacturing it, the ingredients are mixed together in steam-coil lined kettles three and four stories deep. The capacity of each of these is from ten to twelve carloads of soap.

When sufficiently boiled, the liquid is poured into a molding truck and solidifies into a large cake weighing up to a thousand pounds. This is put on a cutter and sliced into slabs, then into strips and again into cakes. These are wrapped by machinery having a capacity for 45,000 bars a day. Even the wood shipping containers are nailed with a special device. Wherever possible, laborious handwork has been supplanted by specially designed machines.

When shipped into the Union Stock Yards, livestock is consigned to various commission firms, members of the exchange. The animals usually arrive at night and are unloaded in the morning before the market opens. The weighing is under the supervision of the Union Stock Yard and Transit company, which issues a certificate of weight covering the sale. The scales are tested frequently by city inspectors and the seller is free to check the weights.

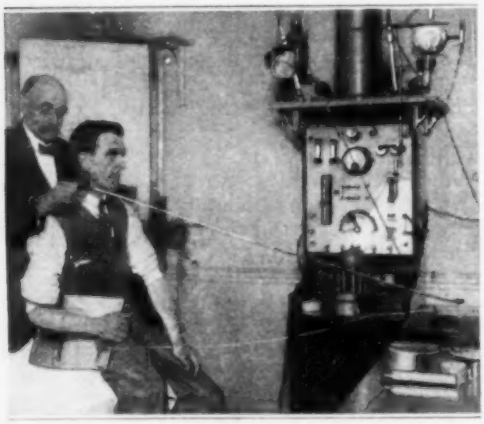
The pens making up the yards cover about a square mile. "Packingtown," composed of some twenty-five plants, occupy about half of this area. The day's activity begins long before the rest of the city is out of bed with the unloading of the cattle. Spurred on by the quaint cries of the drivers, the animals are sorted, fed and placed in separate pens for the inspection of the mounted buyers.

Among them may be noted men of the range type. These are the brand inspectors—detectives of the cattle world—many of them being former cowpunchers. They are employed by the western cattle raisers associations. If a shipper tries to market a steer branded with any except his registered mark, the brand inspector singles out the animal and sees that the lawful owner receives the proceeds of the sale, thus eliminating the cause of many hot disputes.

Brand Inspectors Who Protect Buyer and Seller at the "Yards"

METAL TAPE TO GUIDE X-RAYS STOPS DANGER OF BURNS

Improvement in X-ray treatments is said to have done away with the danger of burns to patients. The beam, like an electric current, can be conducted by a metallic tape to almost any point, even into an adjoining room, it has been found. The results obtained from this method are reported to be as satisfactory as those under the old system. A copper plate is placed between the tube of the machine and the affected tissues under treatment, and the metal ribbon conductor is attached to it.



Patient Being Treated with X-Rays Guided on Metal Tape to Prevent Burns

PLOW OPERATED BY MAN DIGS AS HANDLES ARE WORKED

For the cultivation of small pieces of land with less labor than spading by hand, a portable plow, operated by one man, has been designed by a German inventor. The implement is said to have been tested recently, with good results. It is worked from foot-rests on which the farmer stands. The weight of the person handling it gives the necessary hold in the ground, and an upright crossbar, when pushed forward and backward, forces the blade to dig the furrows. Its direction is kept straight by a guide.

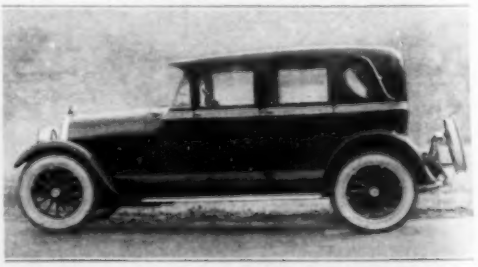
Road Grader Operated by a Long Lever that Requires Services of Only One Man

GASOLINE HAS FUEL RIVAL IN VEGETABLE EXTRACT

As a substitute for gasoline, "natalite," a vegetable extract, first made in South Africa, is said to produce more power to the gallon when used as motor fuel. Although mostly alcohol, the new fluid contains several other ingredients that give it valuable properties. It is claimed that a fire fed by it can be easily extinguished by water, making it an aid to safety. It has also been said that it will not dilute lubricating oils to the same extent as gasoline and similar solution will.

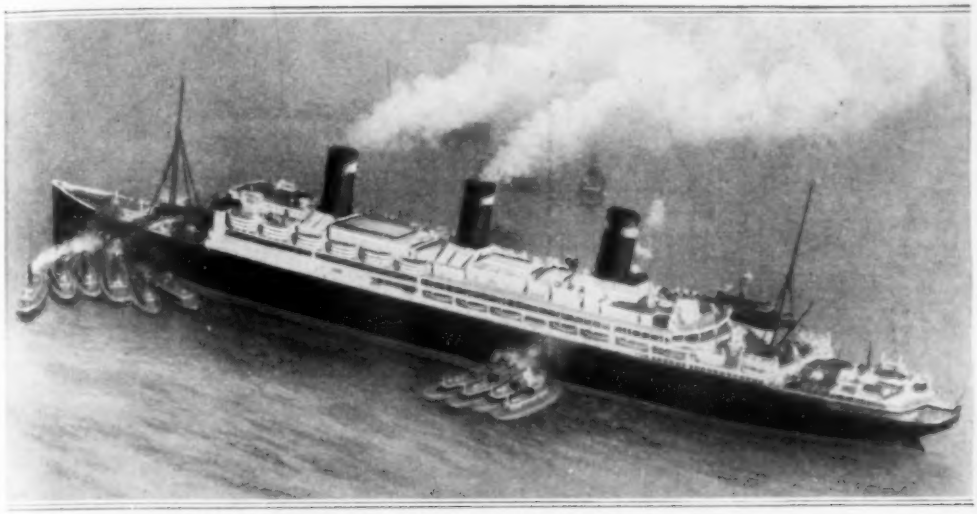
AUTO BODIES MADE OF FABRIC END SQUEAKS AND RATTLES

Fabric, which holds its shape, is durable and is washed or dusted easily, is being employed successfully in place of metal in the bodies of a French automobile, celebrated for its silent-running qualities. With the car windows, held in rubber grooves, and the panels manufactured of the leatherlike material, squeaks and rattling common to bodies of steel construction are said to be entirely removed. Limousines and landaulettes of this construction can be built for little more than ten per cent above the cost of the open or touring-type cars, it is said. Though heat and severe blows may blister the covering, its composition is such that in a short time the swellings disappear. It is not scratched or marred by ordinary dusting or washing and saves time necessary in polishing enameled surfaces.



Automobile Body of Leather-Like Fabric that Looks like Metal and Does Not Squeak

TIDE FREES VESSEL WHEN TUG FLEET FAILS



Some of the Fleet of Powerful Tugs that Attempted to Haul the Giant Liner, "Leviathan," from the Grip of a Concealed Mud Bank in New York Harbor, Before the Tide Freed It

After a fleet of powerful tugs had failed to free the giant ocean liner, "Leviathan," when its prow became stuck in a mud bank in New York harbor recently, the incoming tide easily floated the great vessel. Despite the fact that but a small part of the hull was imbedded in the mire, it was impossible to move the boat with its own power. Although straining at their burden for hours, the towing craft were unable to budge the steamer until the rise of the water caused a greater depth. Later, divers were sent down to the floor of the bay at that point and are reported to have discovered damage done to water mains that pass under the water near the spot.

HUNDRED-POUND TOPAZ MINED IN WILDS OF BRAZIL

Weighing over a hundred pounds, a topaz, recently discovered by an American explorer engaged in a gem-hunting expedition in Brazil, is believed to hold the world's record for size. Triangular in shape, it measured nine inches by ten by seventeen, and casts its yellowish gleams with a sparkle equal to similar stones of the smaller varieties. The curio is now the property of a Chicago museum, where it graces a prominent place among like exhibits.

THOUSAND-YEAR-OLD CANOES FOUND BY DREDGERS

While dredging the bottom of a lake in New Jersey, workmen raised the remains of three large canoes, thought to have been built by Indians who lived almost 1,000 years ago. Experts believe that the boats were preserved by being entombed in peat ever since they sank.

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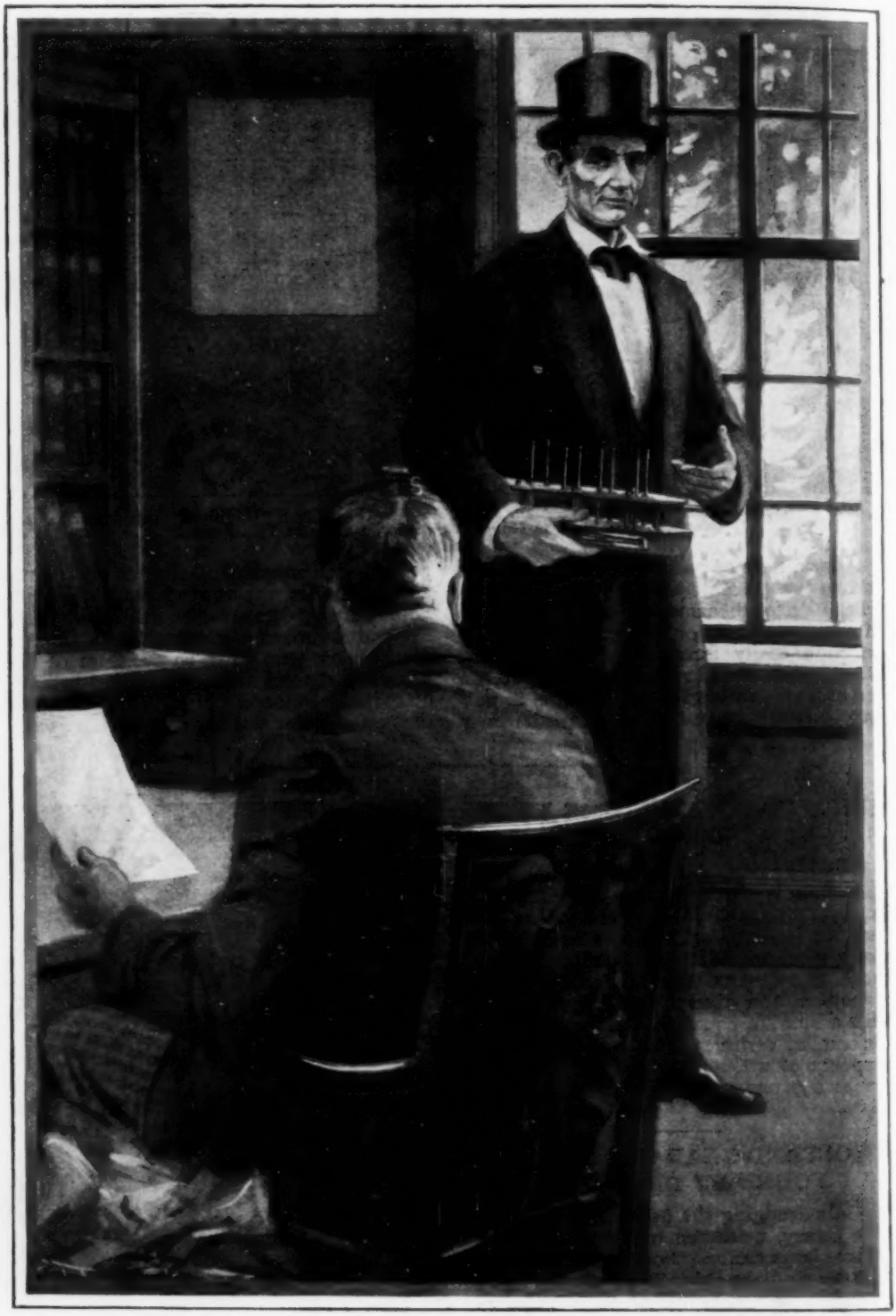
Huge Topaz that Would Make Settings for Hundreds of Rings Is Museum Curiosity



Abraham Lincoln Showing Whittled, Wooden Model of His Only Invention to W. H. Herndon, His Law Partner, Who, It Is Recorded, Did Not Think Much of It

ABRAHAM LINCOLN AN INVENTOR, PATENT RECORDS REVEAL

WHILE every schoolboy is familiar with the life of Abraham Lincoln—a pioneer home, few books, hard labor at all the many trades of the frontiersman and the battle to save the Union and abolish slavery—few know that he also was an inventor.

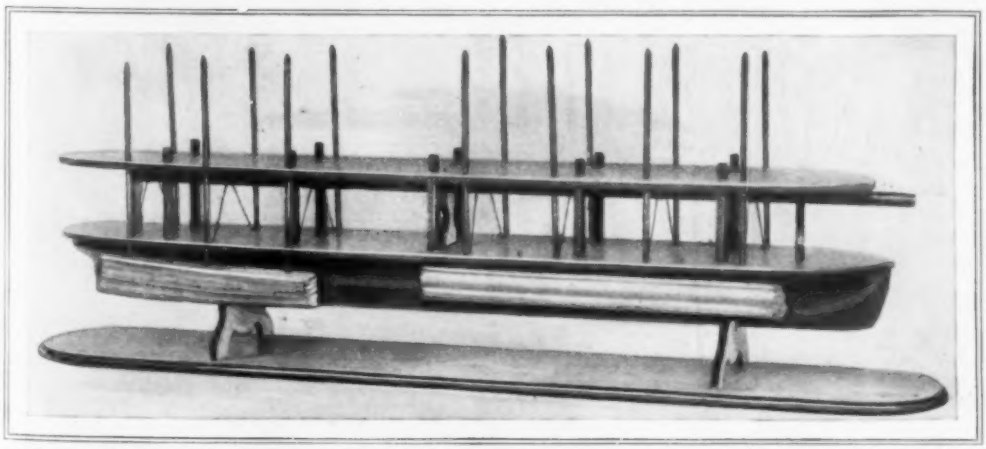
To his genius as a statesman a united nation today bears witness, but only a rude model in the archives of the National Museum at Washington remains to give mute evidence that he possessed an inventive ability that alone, if followed, might have won him enduring fame.

Appearing as though it had been whittled out of a shingle and a cigar box, the model is about eighteen or twenty inches long, and bears the inscription: "6469, Abraham Lincoln, Springfield, Illinois. Improvement in method of lifting vessels over shoals. Patented May 22, 1849."

The apparatus consisted of a bellows placed in each side of the hull of the craft, just below the water line, and worked by an odd, but simple, system of ropes and pulleys. When the keel grated against the sand or obstruction, the bellows were designed to be filled with air; and thus, buoyed up, the vessel was expected to float over the shoal.

It is declared that the idea for this device probably originated when he was twenty-one years old and started out for himself by contracting to build a flatboat to take a few barrels of produce to New Orleans, for which he was to receive twelve dollars a month. Before beginning the journey, he split 400 rails for every yard of brown jeans dyed with white-walnut bark that were necessary to make him a pair of trousers.

After proceeding as far as New Salem, the crude craft stuck on a mill-dam and there for twenty-four hours it hung, the bow in the air and the stern in the water, the cargo slowly settling backwards and shipwreck almost certain. With most of the residents of the town looking on and shouting advice, Lincoln unloaded the boxes and barrels into a neighboring boat and tilted his craft. Then by boring a hole in the end extending over the dam, the water was let out. This done, the boat was shoved over and reloaded. Twenty years later he embodied this experience in the curious invention for getting vessels over shoals, the final inspiration resulting from a journey between Niagara Falls and



Model in the National Museum at Washington, the Inscription on which Reads: "6469, Abraham Lincoln, Improvement in Method of Lifting Vessels over Shoals; Patented May 22, 1849."

his home in Springfield, Illinois.

On his way westward, the boat on which he made part of the trip was stranded in shallow water and had to be pried loose. First a large pole was driven into the mud and then a winch and rope were attached to it to pull the steamer free. When Lincoln reached home he began to build the model representing his idea, whittling at it in his law office while talking on its merits and the revolution it was going to work in river transportation. It is recorded that his partner, W. H. Herndon, did not think much of it and sought to discourage him.

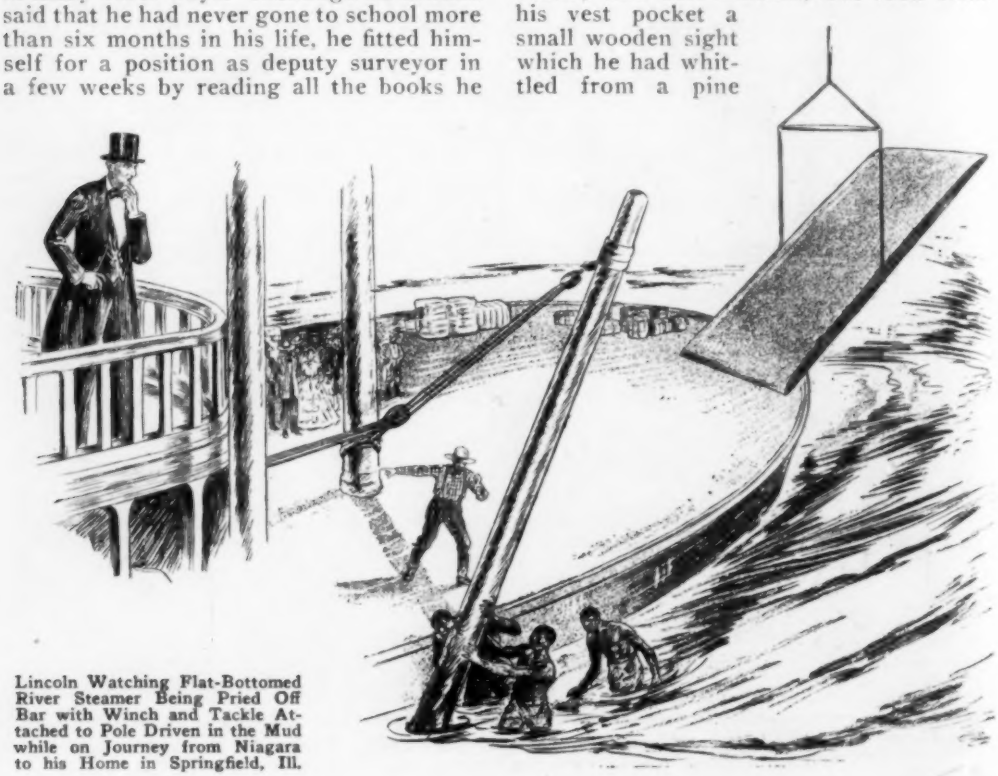
But when the future president returned to his seat in congress, he took the miniature with him. "One morning he walked into my office with a model of a western steamboat under his arm," said Z. C. Robbins, a lawyer, in describing the incident. "After a friendly greeting, he placed it on my desk and proceeded to explain the principles embodied therein that he believed to be his own invention, and on which, if new, he desired to secure letters patent. I speedily came to the conclusion that his idea was of value and procured a patent."

Lincoln's inventive ability and his interest in mechanics, however, were shown in many other ways. Although he himself said that he had never gone to school more than six months in his life, he fitted himself for a position as deputy surveyor in a few weeks by reading all the books he could find on the subject. According to tradition, he was too poor to buy a chain and, instead, used a long, straight grape vine. He also acted as pilot for the first steamer to make the trip from Beardstown to Springfield.

After he became president, and in the opening days of the civil war, the need for arms opened the way for inventors and Washington was overrun with men having guns to test. Mr. Lincoln took the greatest interest in these new arms and it sometimes happened that when an inventor could get nobody else in the government to listen to him, the president would personally test his gun. One such incident is told by a former clerk in the navy department. He accompanied Mr. Lincoln to the lawn south of the White House, where the president fixed up a target cut from a sheet of white congressional note paper.

"Then pacing off a distance of about eighty feet," writes the clerk, "he raised the rifle to a level, took a quick aim and drove the round of seven shots in rapid succession, the bullets shooting all around the target like a gatling gun and one striking near the center.

"'I believe I can make this gun shoot better,' said Mr. Lincoln, and took from his vest pocket a small wooden sight which he had whittled from a pine



Lincoln Watching Flat-Bottomed River Steamer Being Pried Off Bar with Winch and Tackle Attached to Pole Driven in the Mud while on Journey from Niagara to his Home in Springfield, Ill.

stick, and adjusted it over the sight of the carbine. He then shot two rounds and of the fourteen bullets, nearly a dozen hit the paper."

Mr. Lincoln also interested himself in balloons and was one of the first persons in this country to receive a telegraphic message from a balloon sent up to make observations on an enemy's works across the Potomac river.

During Lincoln's career as a lawyer, he enjoyed particularly work in which mathematical or mechanical problems were involved. In 1855, he was retained as one of the counsel for John M. Manny, of Rockford, Ill., manufacturer of reaping machines, who had been sued by Cyrus H. McCormick, owner of patents granted in 1845 and 1847. If McCormick had been successful in his contentions, Manny would have been enjoined, his factory stopped and a claim of $400,000 damages demanded from his firm.

Another noted case involved the future of western commerce. A steamboat had struck one of the piers of a bridge built by the Rock Island railway across the Mississippi river and burned. The trial was a dramatic episode in the war long waged by the river men against the plains beyond. For decades the stream had been the willing burden-bearer of the west. Now, however, the railroad had come to carry the traffic which the river claimed. The boat men claimed that the great waterway could not legally be obstructed by a bridge.

Lincoln argued the case for the railroad, his speech being full of nice mathematical calculations designed to show that the accident was the fault of the pilot. The pith of his contention was that "one man had as good a right to cross a river as another had to sail up or down it."

In this connection, he is said to have drawn a vivid picture of the future of the great west lying beyond the river, and argued that the necessities of commerce demanded that the bridge across the river be a conceded right. In this view he was sustained by the court's decision.

FARMS IN CITIES PREDICTED IN SEVENTY-FIVE YEARS

Small farms within the city limits, double and triple-decked streets, and greatly enlarged traffic accommodations of all kinds, will be needed by New York within the next seventy-five years, it is predicted, to care for the 29,000,000 inhabitants who by that time are expected to call the city their home.

STATUES OF MUMMIES START FAD AS ORNAMENTS

Using characters in Egyptian history as subjects, manufacturers have founded a new industry by making bronze-colored

Bronzed Terra-Cotta Mummy Statue of a Princess Being Removed from Baking Kiln

mummy statues of terra cotta. Art of this sort is in demand in hotels and civic centers for purposes of interior decoration. These realistic antiques, life size or larger, are said to be faithful replicas of originals in famous museums, and it is claimed that they possess the lasting qualities of marble or bronze.

FAN ON FURNACE TO SAVE FUEL SPREADS HEAT AND AIR

To save coal by forcing heat to all parts of a house, a fan made for attaching to a furnace is said to ventilate the building at the same time. By driving warm air away from the fire before it can mix with waste gases, the blower reduces the amount of fuel energy that is usually drawn off by the chimney. Since it keeps fresh drafts continually circulating through the ventilators, more healthful conditions are believed to exist with its use than under other methods. It is claimed that the device, which operates by electric motor, maintains even temperatures throughout the dwelling and that it can be used for cooling during summer months without detaching it from the furnace.

MOSAIC ARTISTS FROM ORIENT BUILD MOSQUE IN PARIS

Artisans skilled in the designing of mosaics have been sent from Morocco to Paris to assist in the construction of a Mohammedan mosque there. For several

Assembling the Block of a "Puzzle Picture" that Will Adorn Paris Mosque

months, they have been engaged in fashioning the intricately patterned decorations for the building. The designs are first put together on flat boards. The blocks, thousands in number, are then assembled in much the same way that a puzzle picture is pieced together. Color harmonies are achieved that rival the shades of the softest tapestries. Great mechanical as well as artistic ingenuity is needed to fit the pieces into solid, smooth surfaces. The workers are being housed in the already finished rooms of the mosque which will have, with the mosaics, elaborate decorations in cedar wood, and will also provide homes for student members of the Mohammedan faith while they are in Paris.

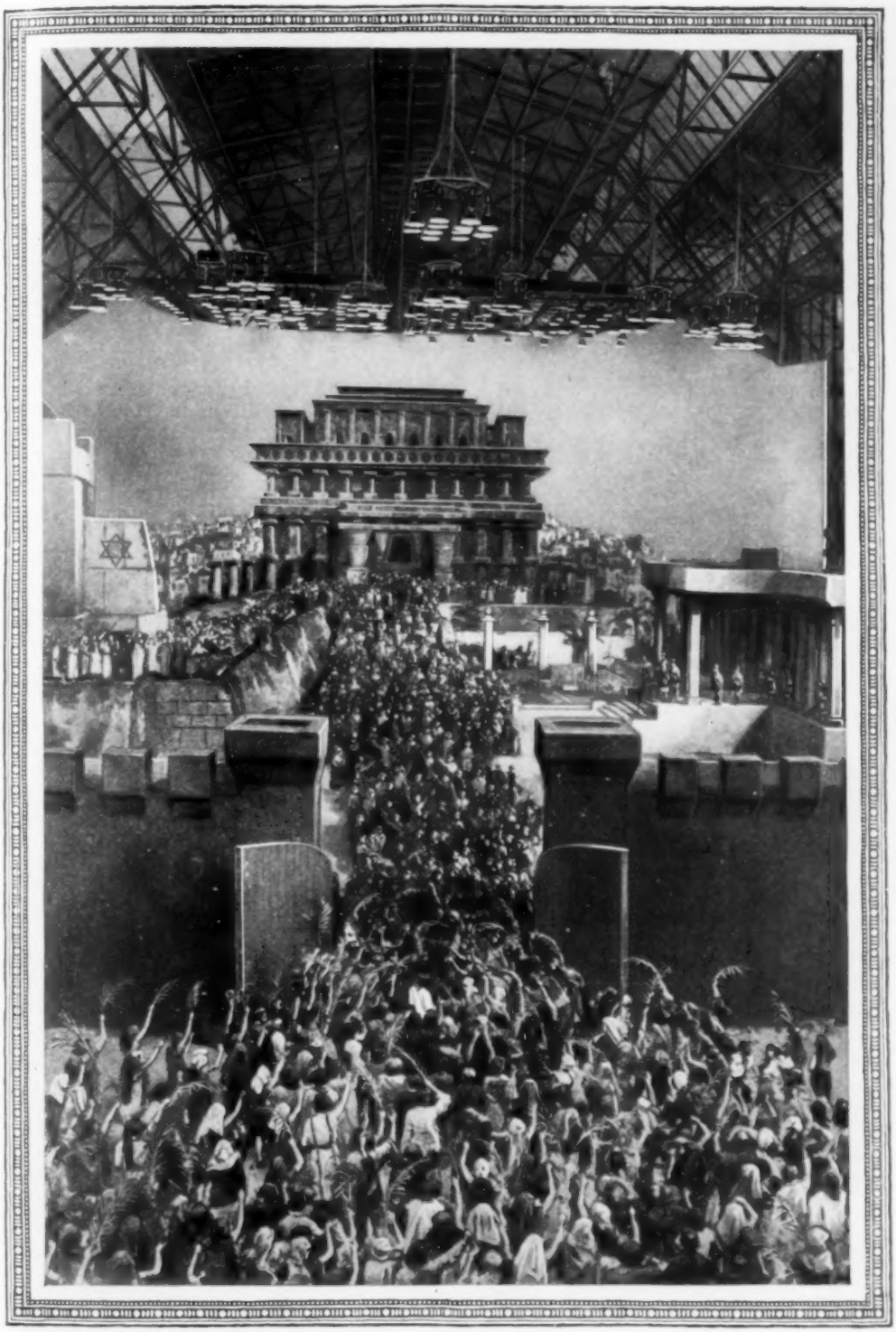
LIGHTNING ROD'S USE GROWS: AN AID TO RADIO

Misled by a published announcement, Popular Mechanics Magazine, in its January issue, printed an article which said that the use of lightning rods was dying out. Upon investigation, it has been found that this statement is entirely erroneous. Including small plants, there are now more than thirty establishments manufacturing lightning rods in the United States. Their output in 1922 was approximately 9,500,000 linear feet, according to the reports of the department of commerce. Recommended by the weather bureau and by many scientific bodies, lightning rods are now sold and manufactured under conditions totally different from those that prevailed in the days of the "ballyhoo" agents who disposed of worthless outfits at exorbitant prices. They are now considered so efficient that more than sixty per cent of the farm buildings in Illinois are equipped with them, forty-four per cent in Ohio and nearly fifty per cent in Iowa. Figures received from 121 insurance companies in fifteen middle-western and eastern states where thunderstorms are common, show that the rods have afforded one hundred per cent protection in many communities over periods of from one to five years. One hundred and thirty companies reported that the average loss on unrodded buildings struck by lightning was $200 and on rodded buildings only $10. Use of the rods has become so widespread that the bureau of standards has prepared official specifications for them which will be made part of the national electrical code. That lightning rods are scientifically sound in principle is also evidenced by the fact that Underwriters' Laboratories maintain and operate a comprehensive inspection program whereby the installations made by the thirty-five manufacturers who subscribe to their service are thoroughly inspected and labeled. The final approval or certificate of compliance with established standards appears on each installation in the form of an etched aluminum master label. With the popularity of the radio, a new use has been found for the rods, as they have proved an excellent ground connection and also afford extra protection to aerials during storms.

HANGAR FOR GIANT ZEPPELINS IS MADE MOVIE STUDIO

Instead of building a large new structure in which to carry on its work, a German motion-picture producing company has taken over one of the big hangars formerly used to house Zeppelin airships. It affords the advantage of permitting the building of huge temples, lofty towers, and tall city walls, and staging plays throughout, all indoors. One of the stories acted out before the camera in the hangar studio is "I. N. R. I.," which deals with the dramatic episodes during the beginning of Christianity. One scene of the piece portrayed the city of Jerusalem in realistic imitation of its existence over 2,000 years ago.

¶ Vandyke brown is one of the slowest-drying colors known to the painter, and should always be mixed with plenty of japan drier.



Courtesy of the Sketch

One of the Mammoth "Movie" Sets Erected in a Former Zeppelin Hangar, Showing Scene from a Biblical Film, which Portrays the Career of Jesus of Nazareth

WORMS THAT DANCE ON WAVES ARE PUZZLE TO SCIENCE

Millions of tiny worms that "dance" in the moonlight on the surface of the sea during the egg-hatching season, and trans-

form the waves into the appearance of vermicelli soup, have been observed off Samoa, the Antilles, and the coast of France. They appear at the first and last quarters of the moon and in the months of May, September, October, and November only. They are so small that it is estimated that more than 1,000,000 occupy the space within the radius of a small lantern.

NAVY'S ELECTRIC FLEET HAS POWER FOR GIANT TASKS

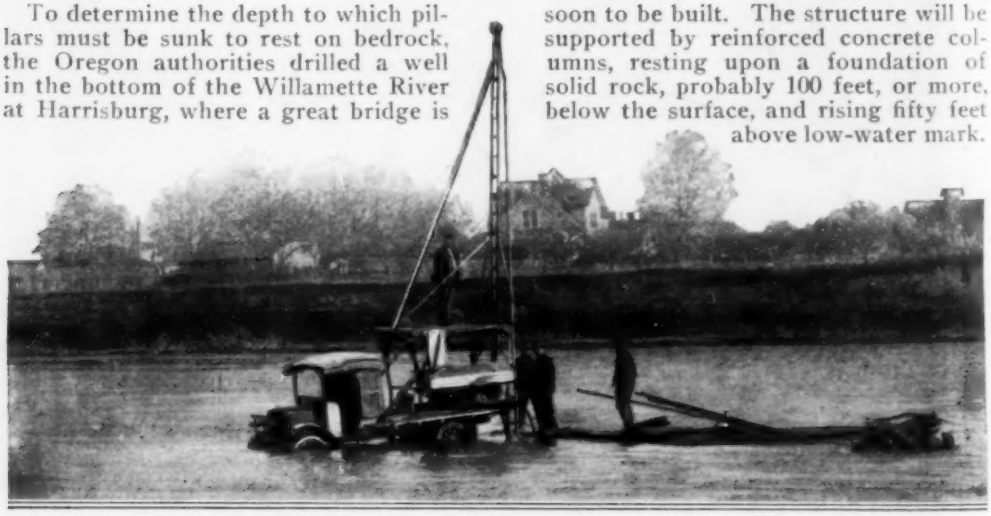
Electric energy generated by the six battleships propelled by electricity now numbered among the navy's fighting craft, according to engineers, if applied to other tasks could furnish sufficient power to run 3,200 street cars or pull forty-eight passenger trains. A mountain of solid rock 5,000 feet high and the same distance through the base, if placed on an immense jack, could be lifted by the force required to operate the vessels, at the rate of a foot a day. Connected to pumps, it is enough to drain Lake Michigan at such speed that the level would be reduced 10 feet a year, or it could light, heat, and furnish power to 600 towns with populations of 5,000. Were it possible to use the energy in artillery, 200 tons of shells could be shot onto the moon each day.

JAPAN IS ENLARGED BY QUAKE AND SHORE LINE CHANGED

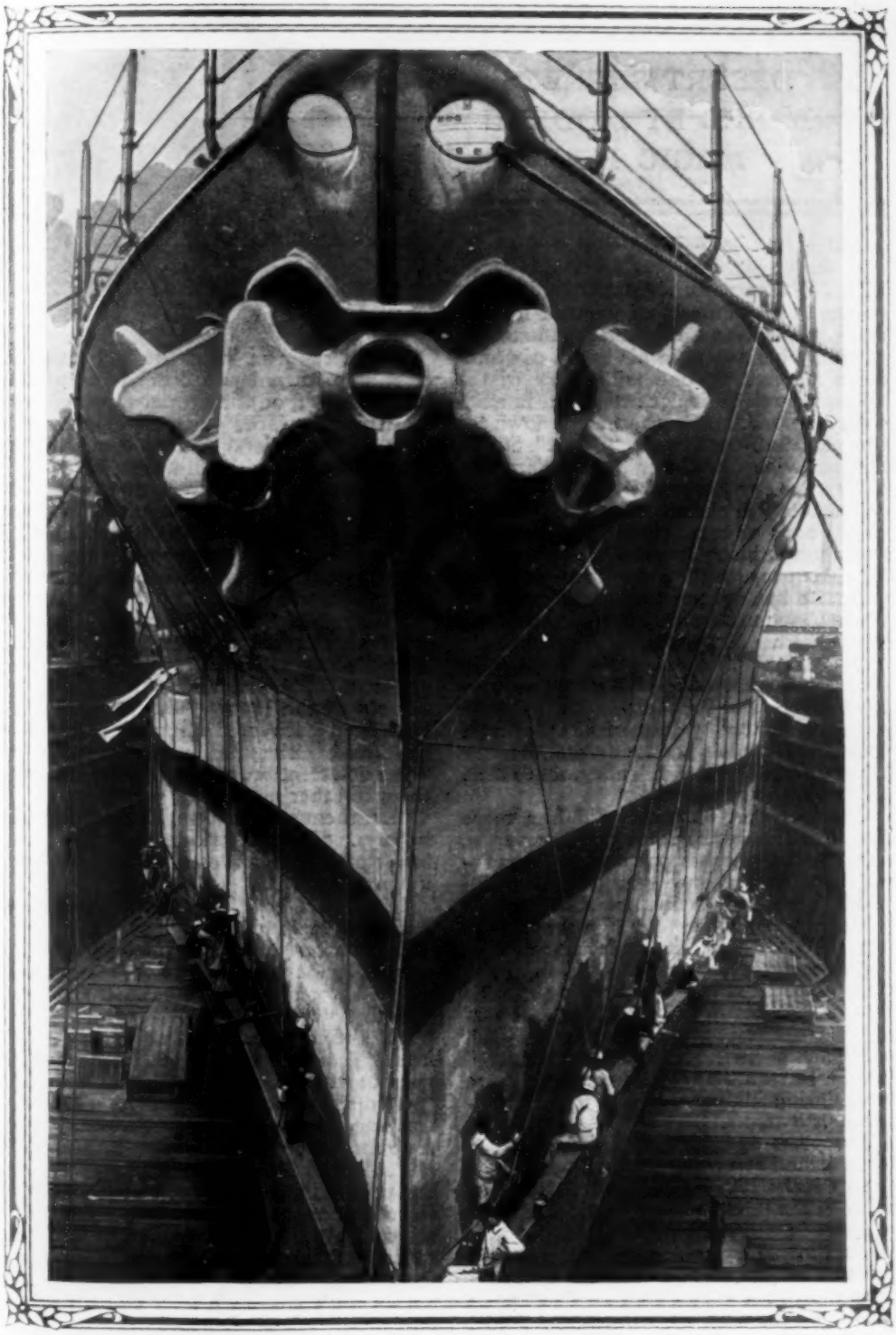
As a result of the recent earthquake, Japan's area has been considerably extended. Also there has been a marked change in the shore line around Sagami bay, the center of the disturbance. According to experts, the bay is many fathoms deeper and rocks, heretofore immersed, are showing, forming small islands, while residences built on the seashore have considerable stretches of land between them and the beach.

WELL SUNK IN BED OF RIVER TO FIND DEPTH OF ROCK

To determine the depth to which pillars must be sunk to rest on bedrock, the Oregon authorities drilled a well in the bottom of the Willamette River at Harrisburg, where a great bridge is soon to be built. The structure will be supported by reinforced concrete columns, resting upon a foundation of solid rock, probably 100 feet, or more, below the surface, and rising fifty feet above low-water mark.



Drilling Down to Bedrock in the Willamette River to Determine the Necessary Depth for Caissons



Fighting Face and Mammoth Anchors of the Electrically Propelled Warship "Colorado"; a Swarm of Workers Are Applying the First Coats of Paint to the Ironclad Hull

DESERT SECRETS BARED BY MODERN MAGIC RUG

By H. H. DUNN

FLYING some hundred miles a day over the barren deserts of western Nevada and southeastern California is the method of riding his hobby in his hours of recreation adopted by one millionaire of the West, though he is not interested in aviation. He is F. M. Smith, better known for the past half-century as "Borax" Smith, the man who found a million dollars hidden in the dry lakes of Death Valley.

His hobby is chemistry and the analysis of dry soils of barren parts of the world, and, though he has been devoting most of his spare time to it for the past twenty-five years, he has not yet exhausted the varying soils and mineral deposits of the American desert. Mr. Smith is 75 years old; fifty years ago, he was a wood cutter in the Nevada desert, supplying fuel on contract to mines of that section. He discovered the mineral values of the drainage basins in Nevada's bad lands, and, later in the great sink of Death Valley, more than 400 feet below sea level.

The world of business paid him more than a million dollars for his discoveries, and he tried various pastimes, yacht racing, in which he once won the King Edward Cup; horse racing, in which he also was a winner; travel took him three times around the world; the collecting of rare books and statuary engaged him for a time. But a quarter of a century ago, he returned to his first hobby, the study of chemistry, and the carrying on of original experiments in it, which had entertained him in his hours of rest in the little cabin built during his years as a wood contractor on the desert.

Ten years ago, he lost the bulk of his fortune, and returning to the desert at the age of sixty-five, started to build up another in the land he knew best. Today he is again in the millionaire class, but that is another story, since he has retained through all the years of fortune and failure and fortune again, his "side line," as he calls it, of chemical experiment and study. When he struck the upgrade, about eight years ago, he removed from its desert setting the cabin in which he had made his first step toward wealth, and installed it, under a roof, on the grounds of his home. Inside it he placed all the equipment of a first-class and far-advanced chemical, soil and mineralogical laboratory. In front of the cabin, from a tripod of silver birch trunks, hangs the old iron kettle, in which he cooked his own food, and in which were reduced many of the mineral salts of the desert, while he was living alone in the waste spaces.

Today, Mr. Smith devotes at least two hours, and often more, of every day to experiments with soils, samples of saline deposits, minerals, and rocks from the deserts of the West. Through his work have been discovered a number of valuable deposits of minerals, but to these he devotes no attention, other than to announce them to other men.

"Let them go after 'em, if they want to," he says. "I would rather find out what is inside of a mountain on the desert than cut it up and sell it."

In the old days, Mr. Smith walked to find his samples of strange minerals; then he rode a mule, which grew into a team. From that he moved up to an automobile, which he equipped with solid truck tires, and thus was able to drive over cactus, boulders and other desert obstructions, far from railroads or highways. Now when he goes to the desert on what he calls his "personal prospecting trips," he flies in an airplane, lands when he sees a soil, hill or rock formation which is new to him, and studies it as long as he desires. Flying out at random from any one of several different towns, at one of which he has instructed his pilot to meet him, he watches the earth beneath until he sees something new, or something which attracts his attention by its difference of color, formation or elevation. Landings can be made by airplanes at almost any point on the American desert, and there is always

enough level land for the take-off, so that he is enabled to reach little-known and less-explored regions in a flight of two or three hours, make investigations, take samples, and return to the railroad station, all in time for dinner in the evening of the same day on which he started.

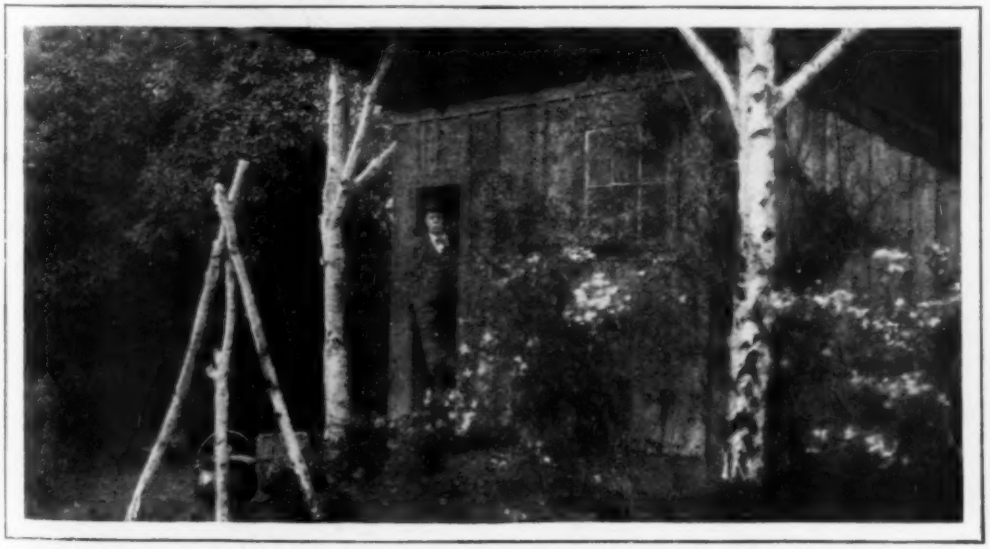
This would seem to be a rather strenuous hobby for a man who has seen seventy-five years on this globe, especially when it is followed by close application to the test-tube, the retort and the furnace in his little chemical laboratory at his home. But to him it is far easier than any of the other methods by which he has studied the subject for a quarter of a century.

"At last, I've got speed," he said to me as he showed me a lump that looked like white clay, and in which he had found and identified traces of twenty-seven minerals. "All my life in this pastime of mine, I have been hampered by the immense distances of the desert, and lack of speed in transportation. Now, I can laugh at the distance, and I know more about the desert than I ever did before. Indeed, I have learned more about it in the past two years with an airplane than I learned in fifty years before with walking, mule riding, mule driving, and motoring.

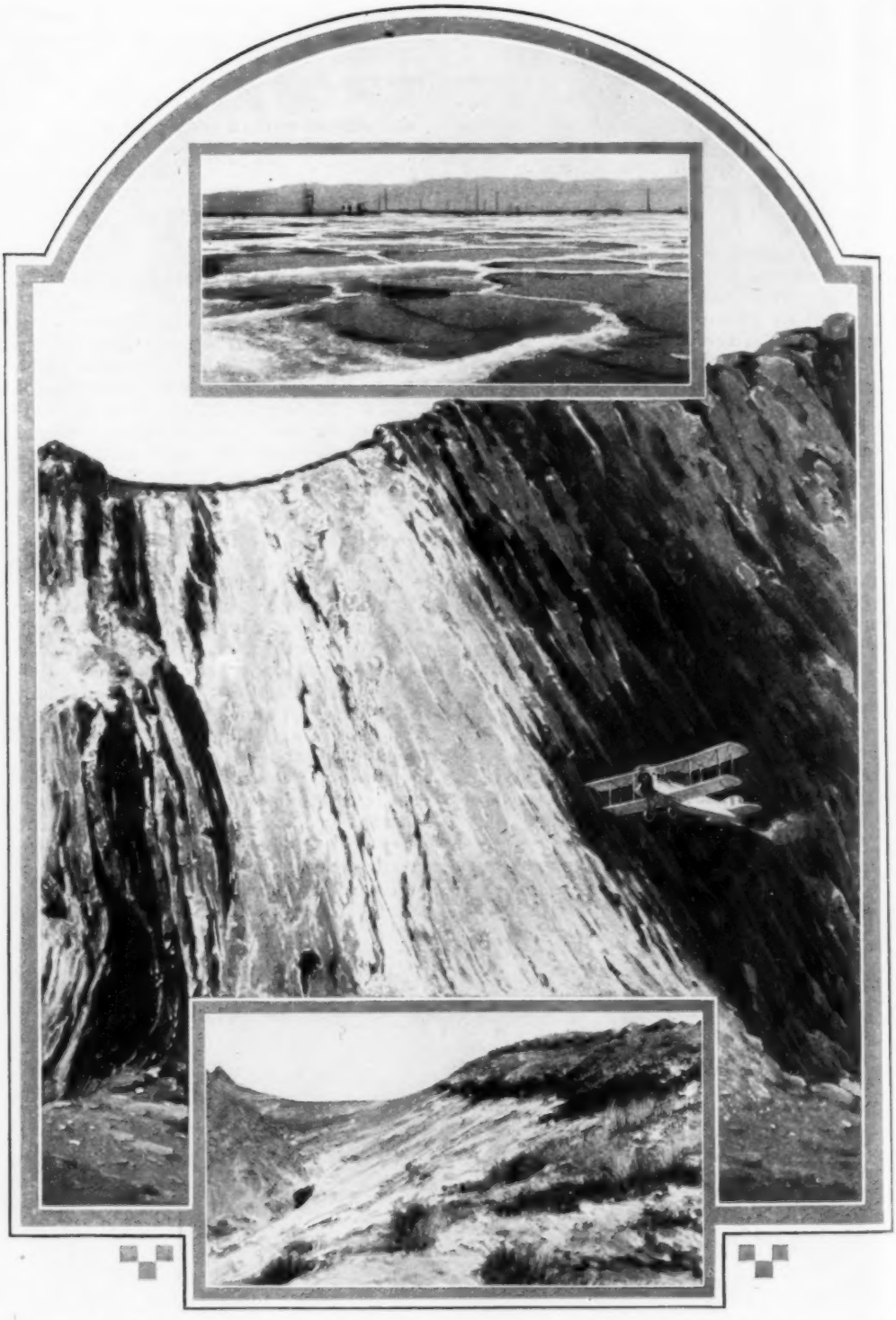
"The desert is the world's greatest natural storehouse of chemicals and we can find there vast deposits of many useful minerals in the form of saline salts," he continued. "Of the presence of most of these on the desert, man has no inkling, largely because they have been deposited by evaporation, and, consequently, are found only in the driest, most distant and least-explored, as well as most inaccessible, sections. There are thousands of square miles in Nevada, Arizona and California which a white man has never seen, and hundreds of square miles that even an Indian would hesitate to enter. The airplane lays these open to the view of man and to the study of chemists. The man who looks for fortune on the desert is more apt to be rewarded by death, but the one who seeks there for practical, worth-while knowledge, will find more than he can assimilate in a lifetime."

As an example, Mr. Smith, with his airplane and his test-tubes, discovered a mountain of gypsum, a three-mile dike of borate of lime, and a hill of almost solid sulphate of magnesia (Epsom salts), in the heart of the Muddy Mountains of Nevada, a bit of the desert which is not inhabited, even by Indians, and so far as known, has been crossed only once by white men. Mr. Smith found lumps of the three minerals in old washes at the foot of the range. Curiosity led him to fly into these mountains, to endeavor to learn whence the fragments came. He found all three deposits, and there they still are, for, beyond making public his discoveries, the interesting old westerner takes no further steps. Whenever he makes a find of this kind in the desert, he tells the world about it through the newspapers, and then lets the world do what it pleases with the discovery.

On one of his flying trips into the desert of southwestern Nevada, he saw beneath



Cabin in Which "Borax" Smith Lived Fifty Years Ago, When He Was Woodcutter on the Desert; Now in Garden of His Home Where It Is Used as a Laboratory



Above, Vast Deposit of Mineral Salts: Center, Flying Along Dike of Lime; Below, Hill of Gypsum. All Discovered by Smith in His Trips Across the Desert

the plane a flat, gray field. Descending to examine it, he discovered it to be of the same color, and apparently of the same composition, as the lower end of the Imperial Valley, the tremendously fertile delta of the Colorado River. Chemical analysis of samples he gathered made in his fifty-year-old cabin, confirmed the first thought, but the question of how this large deposit of alluvial silt came into being in the heart of a dry desert where there are no rivers and where a fraction of an inch of rain falls once every four or five years, is a mystery which not even the expert has been able to solve.

"If water could be put on that plain," he says, "it would be the most productive farm in America—and some day it will be done, but the chemists and engineers will have to show us how."

On another flying trip, Mr. Smith stopped at a spring to take on a supply of water. He was looking at a piece of "float" gypsum, when an Indian on horseback rode up, who informed him that he knew a ledge of this material. The pilot of the plane and the millionaire desert chemist flew on the Indian's directions and found, at a distance of some twenty-five miles, not a deposit of gypsum, but a ledge of asbestos. Landing to investigate, they found, however, that it was a small deposit of not much value.

In the bed of one of the "dry lakes" of the California desert, Mr. Smith has found as many as fifty-two minerals, all either in the mud, which half-baked, formed the bottom of the lake to a depth of about 20 feet, or encrusted along the shore in crystalline form.

The hobby is a rather expensive one, but the results of it have been of value, not alone to Mr. Smith, but to the country as well.

Rugged and Desolate Desert Mountains—Hunting Ground of 75-Year-Old Pioneer

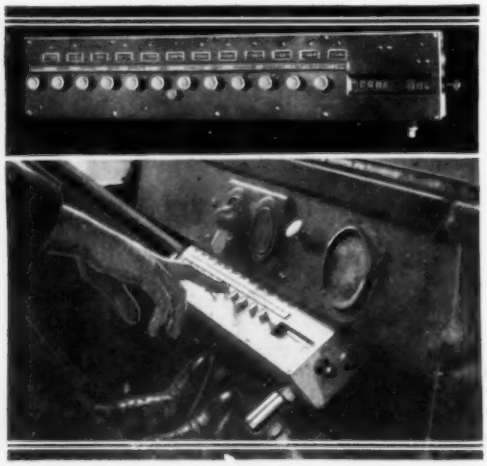
POWDER USED TO KILL WORMS THAT SPOIL GOLF GREENS

Golf greens in some parts of California have been cleared of earthworms by a method which does no injury to the sod. The damage caused by these pests was so great that experts were experimenting with a gas to destroy them. Before their tests were concluded, however, a powdered compound of chemical salts of iron and copper was tried. Dusted lightly over the closely mowed lawn, and heavily sprayed immediately after, with water, it acted quickly. Within a few minutes, worms came to the surface to die and those remaining underground were killed.

¶Land crabs annually do considerable damage in truck farms in Florida by devouring and injuring the young and tender vegetables.

CROPS MEASURED BY METER ON AUTO DASHBOARD

For recording the measurements of fields planted in various crops, a meter attached to the dashboard of an automobile has been included in the equipment of the Department of Agriculture. The instrument is operated from the same gearing mechanism used for an ordinary speedometer. Each crop may be recorded on its particular section and the dimensions of the "stands" are shown in feet. At the right of the device is a scale that registers the total distances covered in miles and the number of trips made. As each patch of a certain kind is measured, it is added to the total. Each scale is labeled and has a button which must be pressed to throw it into action. Ten principal crops are provided for as well as idle ground and pasture land.



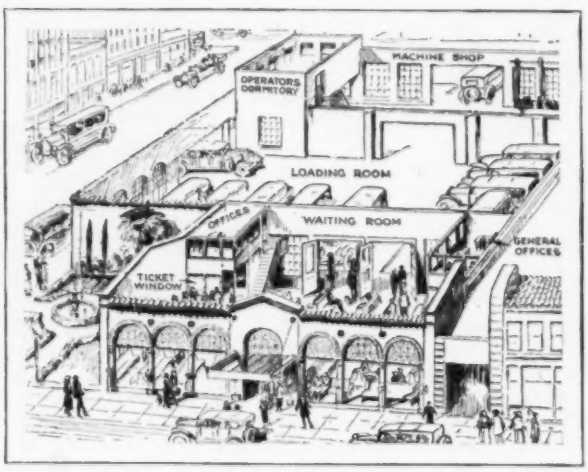
Meter for Dashboard of Automobile that Automatically Measures Fields Planted in Various Crops

DIAL IN NECK OF GASOLINE CAN TELLS THE EXACT MEASURE

To test the exact amount of gasoline delivered by a pump, a special measure has been made with a dial in its neck. This shows at a glance any errors and the correct amount over or under the number of gallons ordered. When the gauge is properly set, being adjustable and removable, it may be sealed so that it cannot be tampered with.

¶Toughness of the skin, and firmness of the flesh of different varieties of plums, are an index to the susceptibility of the fruit to brown rot disease.

AUTO "STAGE" DEPOT HAS COMFORTS OF BIG HOTEL



Automobile "Stage" Depot with Accommodations that Rival Those of Modern Hotels

To provide comfortable waiting rooms for patrons, and furnish employes with proper quarters, an automobile transport company in the west has built a depot with accommodations that rival those found in modern hotels. The entire front of the building is plate glass, and an ornamental canopy, supported by chains, protects passengers alighting at the curb. The second floor is fitted with shower baths, reading room and sleeping chamber for drivers of the cars. There are seven loading slips, and outgoing passengers enter the "stages" from platforms level with the running-boards of the vehicles, thus minimizing danger of accidents. The garage has space for the storage of 20 machines.

WOMEN PLAY PART IN BUILDING OF MODERN SKYSCRAPERS

That the needs of women must be given as much attention as is accorded the sinking of the foundations of a modern skyscraper, is disclosed in the report of the National Association of Building Owners and Managers. This consideration is reflected chiefly in planning for adequate and attractive rest rooms which, it is declared, can no longer be classed as luxuries. Also, human frailties must be taken into consideration, including the habits of messenger boys penciling corridors and jumping down the stairs. The pencil habit has given rise to the term "pencil line" for the height of marble wainscoting, which is raised to such a level that marks may be easily cleaned from the walls. Awning fires are being prevented through dipping of the fabric in a fireproofing substance.

POWDER PUFF HIDDEN IN RING HAS MIRROR IN SETTING

Concealed beneath the setting of a signet ring of novel design is a minute powder box, puff, and mirror for the toilet. The stone is fastened on a hinge and snaps tightly shut over the small holder. The looking glass is under the setting and is

Signet Ring Containing Powder Puff and Mirror behind Setting Open and Closed

tilted at a convenient angle when the top is unclasped.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

CABINET KITCHEN SAVES SPACE IN SMALL APARTMENTS

Combining kitchen, pantry, and refrigerator into small space, a convenient article of furniture, especially adapted for use in

Copyright, Underwood & Underwood

Compact Cooker, Refrigerator and Storage Cabinet for Apartments Where Space Is Limited

three-room apartments, is now on the market. Lockers for storing ice are at the bottom, so that perishable foods placed above are cooled. There are drawers for utensils and supplies, and ample cooking space. With this cabinet, one may prepare a meal, eat it and clear it away without leaving the chair.

LAUGHTER-PROOF TRIBE FOUND IN WILDS OF CEYLON

For more than 2,000 years, it is said, laughter has been unknown to the Veddas, a tribe of aboriginal inhabitants of Ceylon, who have maintained a secluded existence in caves and jungles of the region. Cut off from other peoples and subsisting on bats, owls, and crows that they shoot with arrows, these strange people are said to have lost entirely the sensation of laughter. They are thin and flabby, and a fat man is unknown to them. Efforts of a scientist, who recently visited them, to produce smiles by tickling them on the soles of their bare feet or in the ribs, met with no success. Their stony countenances did not even wiggle.

NOTED ACTORS PREFER CARVING TO PLAYING IN MOVIES

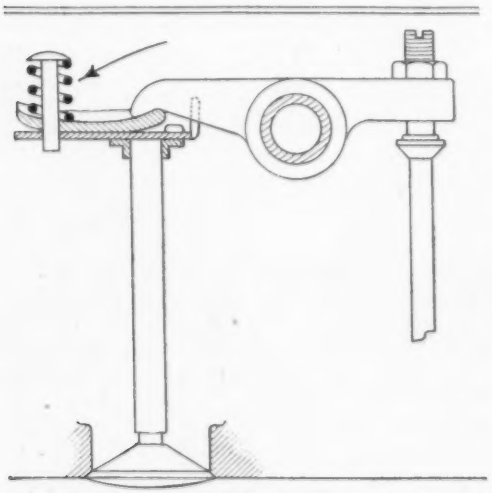
Actors in the famous Oberammergau Passion Play, who came to the United States to raise money to save the people of

Passion-Play Actors Displaying Samples of Beautiful Carvings to Be Sold for Charity

their village from post-war starvation, refused offers of more than $1,000,000 to produce their performance for the movies. They declared that to accept would be to violate a tradition that has been observed for generations. Instead, they followed their craft of wood carving in the hope of selling their wonderful handiwork to raise the much needed funds.

VALVE SILENCER STOPS WEAR AND PUTS END TO NOISE

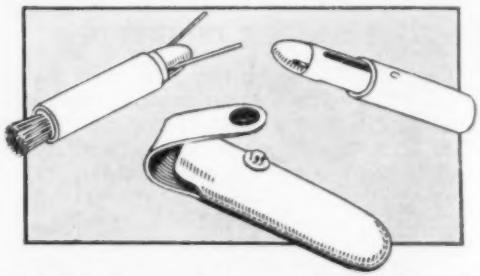
To stop the noisy tapping of the valves in the overhead-type automobile engine, a silencer has been made that embraces an arm feature worked out from the rocking-chair idea. Placed on top of the valve stem, the arm is held in constant contact with the tappet by a spring, and rocks back and forth as the valve opens and shuts. It keeps the motor running smoothly, eliminates play and minimizes wear.



Rocking-Chair Silencer, Held in Place by Spring, that Silences Noisy Overhead Valves

TESTER CLEANS SPARK PLUGS AND FITS IN POCKET

Resembling a cartridge, and small enough to be easily carried in a vest pocket, a combined tester and cleaner for automobile spark plugs has a stiff brush at one end and two contact wires at the other. Both appliances are concealed by a cylindrical cover while not in use. If a plug is found to be missing, it can be removed and quickly cleaned. Metal strands are provided among the bristles to dislodge carbon. A leather cover is furnished to protect the device against damage.



Combined Tester and Cleaner for Spark Plugs that Opens Up when Cover Is Moved

THIRD OF WORLD'S FISH CATCH IS USED IN THE U. S.

That Uncle Sam eats great quantities of fish is proved by recent figures showing that the world annually levies a tribute upon the seven seas of 500 million dollars' worth of this kind of food, of which Europe collects approximately half, the United States nearly a third, and the remainder of mankind the other sixth. In terms of weight, the portion collected by America amounts to 2,600 million pounds, including shellfish. Three-fourths of this reaches the markets in fresh condition; the remainder goes to the consumer as canned, salted, and smoked fish.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine,

MOUNTAIN SPLIT BY DYNAMITE IN MANY HOLES

Tons of Earth Displaced on Mt. Shasta, California, to Make Way for Dam Site: Taken Two Seconds After Explosion Started, Picture Shows Its Downward Sweep

To prepare ground for the construction of a dam connected with a California electrification project, tons of earth on Mt. Shasta were displaced by a single blast of dynamite divided up in over 200 holes. The borings ranging from 16 to 30 feet were filled with the powder. The explosion, which was heard miles away, left a huge rent in the wooded slopes of the mountain, the earth rolling down into the stream.

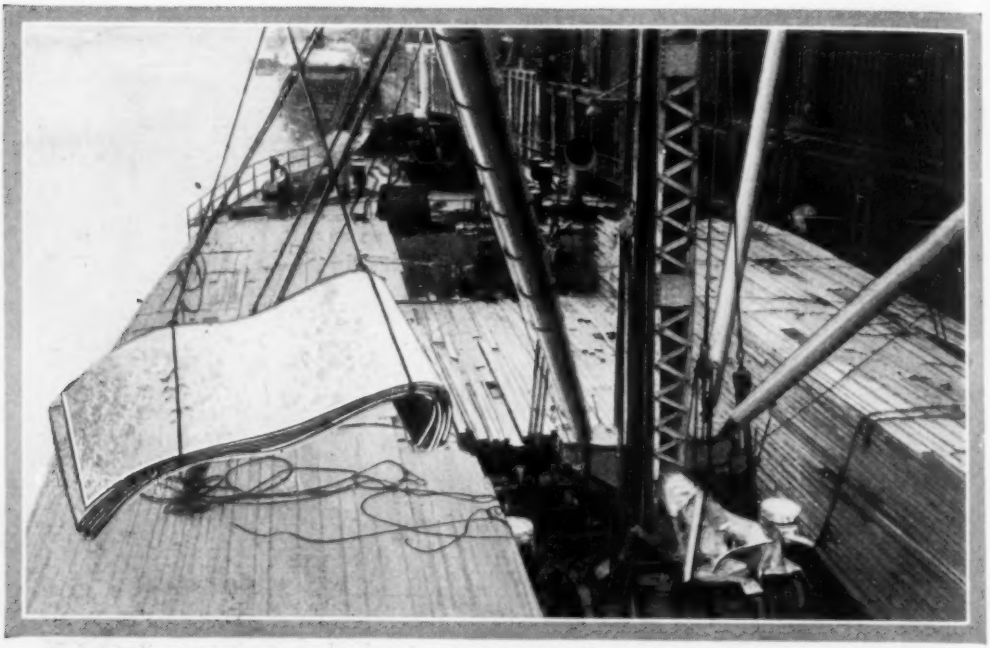
MONKEYS WITH FORKED TAILS SOUGHT IN CHINA

Forked-tailed monkeys, described in Chinese literature as inhabiting the fastnesses of the province of Kweichow, are among the objectives of a scientific expedition to explore that region. Some doubt is held as to the existence of such a species. However, the skin of a huge monkey, believed to have been a member of the largest non-anthropoid species in existence, was exhibited recently by an explorer, who had shot the animal while hunting in the wilds of the territory and indicates that a variety of simian, yet unknown, may be found. The district has been visited by few white men. It lies back of the high mountain ranges that form the watershed of the Yangtze River and is said to be as large as Missouri and as populous as Pennsylvania.

COIN IN SLOT OF "MUST SAVE" BANK OPERATES CALENDAR

Thrift is made to operate a daily calendar in a "must save" bank. A dime automatically changes the date while an extra nickel is required on the first, tenth, twentieth, and thirtieth of each month. The insertion of a quarter alters the name of the month. Thus in a month of 31 days at least $3.55 must be deposited to rotate the calendar. For "conscience" money, a special slot is reserved which receives coins up to half a dollar and folded bills.

KNOCKDOWN HOSPITALS AID IN QUAKE RELIEF



Loading Hospital Buildings on Board Steamer for Relief of Earthquake Victims in Japan; Knockdown Walls and Floors Were Piled on Decks and Other Parts Swung Below

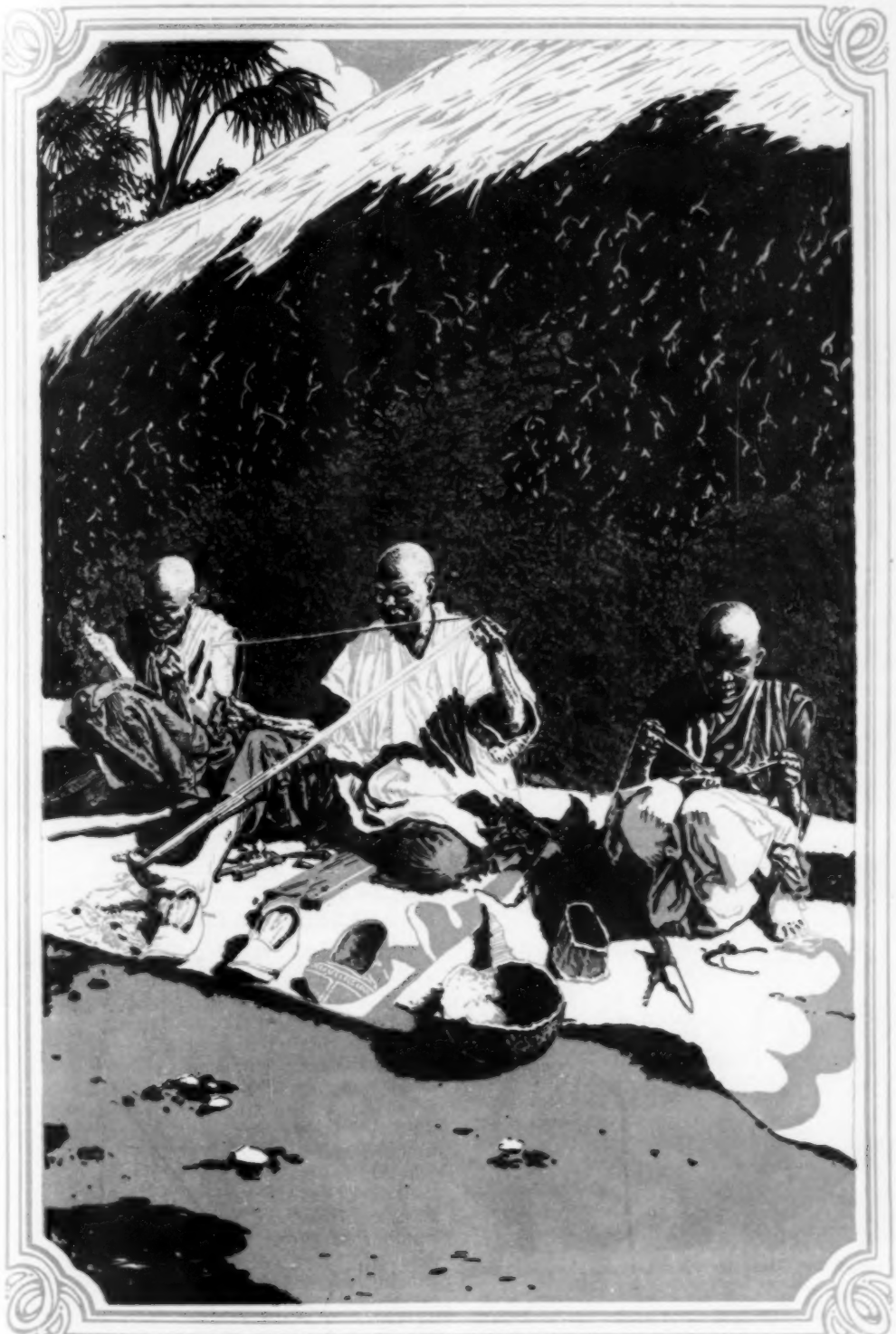
To aid in furnishing speedy relief to survivors of the Japanese earthquake, hospital buildings of knockdown construction were sent from the United States by the American Red Cross and set up in stricken areas as emergency headquarters. The collapsible structures were so compactly prepared for shipment that five complete buildings, a cargo of 4,500,000 feet, were loaded on a single steamer sailing from Portland, Ore. Each hospital was 100 feet long and 26 feet wide. They were erected quickly and easily moved from place to place, the special type of construction proving exactly suited to such an emergency as arose in the stricken land.

SHOES OF PRIMITIVE PEOPLES RECALL ANCIENT CRAFT

Although machinery makes practically all of the shoes now worn in civilized countries, many peoples in isolated regions still wear rudely fashioned footgear resembling that of the ancients. Even in Egypt, where sandals were first constructed of strips of papyrus, social standing among some of the natives can be easily determined by the kind of material employed in the making of their footwear. In China and India, a similar woven sandal is worn, worked from grass strands or leaf fiber. Throughout the tropical sections of the world, crude shoes are made from soft leather and heavy cloth. Instead of the familiar hammer and pegs of the western craftsman, the "village cobbler," of the South Sea Islands, uses thongs and tough cords to bind together the materials that form the awkward, slipper-like foot coverings, which are afterward colored with dyes, or brocaded in brightly hued yarns, to give them a gaudy appearance, befitting the position of the wearer.

CORN SUGAR IS MADE CHEAPLY TO COMPETE WITH CANE

Corn sugar, that costs no more than cane, has been turned out by a process developed by H. C. Gore, a department of agriculture chemist. It is said that the product can be melted and cast into molds, like the fondant made from cane or beet sugar, and used in the candy industry. The operation involves no unusual equipment, and consists essentially of mashing cornstarch, or hominy, with malt, which liquefies the product.



Native "Cobblers" Plying Their Trade in a Tropical Village, Indifferent to the Sun's Burning Rays

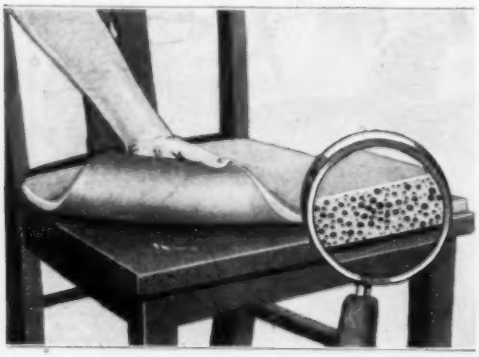
DETAILS OF COUNTRYSIDE REPRODUCED IN MAP

Detailed Map of Famous Old Road Showing Landmarks and Structures Drawn to an Exact Scale

Every hill, valley, river or other landmark of a famous English countryside has been reproduced in miniature with lifelike fidelity to detail, on a great map made by students during their leisure hours. In it are combined the craftsmanship and art of the surveyor, painter, sculptor, and natural scientist. In form and coloring it is startling in its realism although built on the scale of a toy wonderland.

POROUS PAD FOR CHAIR SEAT KEEPS SOFT AND COOL

Cushions that shape themselves to the ordinary chair-bottom without tacks or other fastenings, and that do not wrinkle, have been recently marketed. The pads consist of three layers of rubber fused into one. The two outer sheets are solid, but the inner one is porous like a sponge. It is claimed that these chair-cushions furnish a cool, comfortable seat which is easily cleaned, and last for a considerable time because of a certain amount of ventilation permitted by the tiny air cells.



Cushion that Keeps Its Place without Fastenings and Shapes Itself to Ordinary Chairs

GASES FROM ASPHALT ROADS CAUSE DEATH IN JAPAN

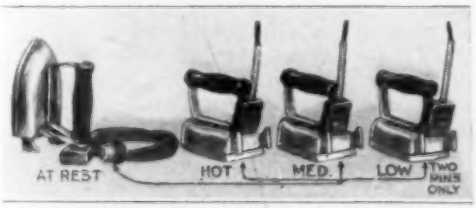
Gases arising from heated asphalt roads are reported to have caused the loss of many lives during the fires that followed the recent earthquake in Japan. Melting under the high temperatures produced by the flames, the surfaces of the highways and streets paved with the material became so soft that the sticky masses halted the flight of many persons. Aged and exhausted persons, and children, found it difficult to make rapid progress because their feet became stuck in the taffylike substance. Poisonous fumes overcame a great number of those whose escape was thus delayed. Engineers and officials in the stricken areas are said to have planned future roads to be built of materials that do not form gases as well as resist intense heat.

MEDICAL TESTS FOR AUTOISTS TO REDUCE ACCIDENTS

To curtail the number of automobile accidents, proposals are being discussed in France to subject all applicants for motor licenses to strict medical examinations to test eyesight, hearing, and action of the heart and nerves. "Stunts" similar to those to which potential aviators are subjected to determine their sense of equilibrium also are being recommended for the motorist to see how easily he becomes dizzy or loses his sense of direction. Inquiry after serious smashups has shown frequently that a driver was deaf, was suffering from defective vision or had some other handicap which a previous examination would have disclosed. Optical tests are now required in certain states.

THREE "HEATS" OF ELECTRIC IRON SUIT IT TO ANY FABRIC

To furnish several "heats," suitable to a variety of fabrics, an electric iron with three different hot stages has been made. Merely by adjusting plugs, the separate



Electric Iron that Produces Three Different "Heats" Suited to Fabrics of Various Weights

temperatures can be produced. It is said that the utensil saves much time in pressing heavy cloths, because it does not chill while worked at high speed and extreme heat, and can be regulated down to a point where it is impossible to injure the most delicate material.

COTTON-PICKER GATHERS CROP AND BINDS IT IN BALE

To pick cotton by suction, an automatic machine has been built that is said to gather an acre of the crop faster and cheaper than could be done by hand. It consists of a tower, and horizontal arms having a spread of thirty-five feet. These have holes in the under side. The ripe product is drawn by vacuum into the hollow gatherers, carried along to a central chute, compressed into bales, and dropped out at the rear.

MOTION PICTURES OF LIPS AID THE DEAF TO SPEAK

By means of motion pictures of the lips of a person speaking, the deaf, children with defective speech, and foreigners are

Taking Stereoscopic Motion Lip Pictures with Special Camera to Aid in Speech Instruction

greatly assisted in their efforts to talk correctly and to interpret sounds by lip-reading. A specially devised camera takes a series of "close-ups," the "model" pronouncing the words taking great care to move his lips in the precise positions for forming the sounds. The pictures are shown with the words and symbols to accompany them, supplying a graphic "pat tern" for the pupils to follow.

TURNING A NUT STOPS BOTTLE, AND PREVENTS LEAKAGE

Leakage from bottles can be prevented by a stopper recently invented, that has a wingnut to fasten the cover tightly to the vessel. On the mouth of the flask, a rubber disk is firmly pressed against the rim. With this seal, there is no need to destroy any part of the cork to remove it. Simply turning the nut loosens the device, and it can be put on again after a portion of the contents has been taken out, or may be fitted to another container of a similar size.

¶Whenever you find that you wish to know more about any article in the magazine, write our Bureau of Information.

TUNNEL UNDER ROOF-O'-WORLD TO ENRICH NATION

Ever since the days of David H. Moffat, other railway men have cherished the ambition to penetrate the mighty barrier of the Rockies with a tunnel that would bring eastward the riches lying on the western side of the Continental Divide, and now this vision is about to be realized, groups of busy workmen being engaged on the great engineering project.

To appreciate the magnitude of the task, it is necessary to realize some of the difficulties of operating trains over the present route by way of the storm-swept Rollins Pass. At the summit is Corona, 11,600 feet above sea level. For two miles snow-sheds stretch out protecting roofs, doing their best to make it possible to run trains during the winter in Cloudland. Trainmen must fight every inch of the way to reach these snowy heights, and after a brief rest they must wage another equally bitter battle to take the train safely down the treacherous grades and around the tricky curves. To surmount the grades, four and five Mallett engines, built especially for mountain work, are needed to pull a single train. And yet it requires nearly fourteen hours to cover one ninety-mile stretch of road.

When the six-mile tunnel is finished, in about three years, twenty-three miles will be cut from the present distance, resulting in a tremendous saving in time and operating costs. On the eastern slope, the bore begins about three miles above Tolland at an elevation of 9,198 feet, and it will therefore be far enough below timber line so the tracks will be protected from huge snowdrifts. The western portal will be 113 feet lower. The tube is to have a peak, or high point, in the center, so it will drain readily. The plan is to drive the work from both slopes, using an eight-foot water tunnel, located at a distance of seventy-five feet from the transportation tube. By means of cross cuts, communication will be established between the two. When completed, it will be electrified. Fires will be banked in the steam locomotives before they enter, to simplify the problem of ventilation. Suction fans also will be installed.

Although Moffat did not live to see his dream of opening up a new commercial empire realized, the tunnel will stand as a monument to his vision. Geologists declare northwestern Colorado alone has sufficient high-grade coal to supply the entire United States for 1,500 years; and its shale beds will produce much more oil than has yet been taken from the wells of the United States. The further claim is made that enough ammonium sulphate can be produced as a by-product to fertilize all the farms of the Mississippi basin. Also, there are in this district 3,900,000 acres of vacant public land open to entry, and 353,000 acres of state school lands.

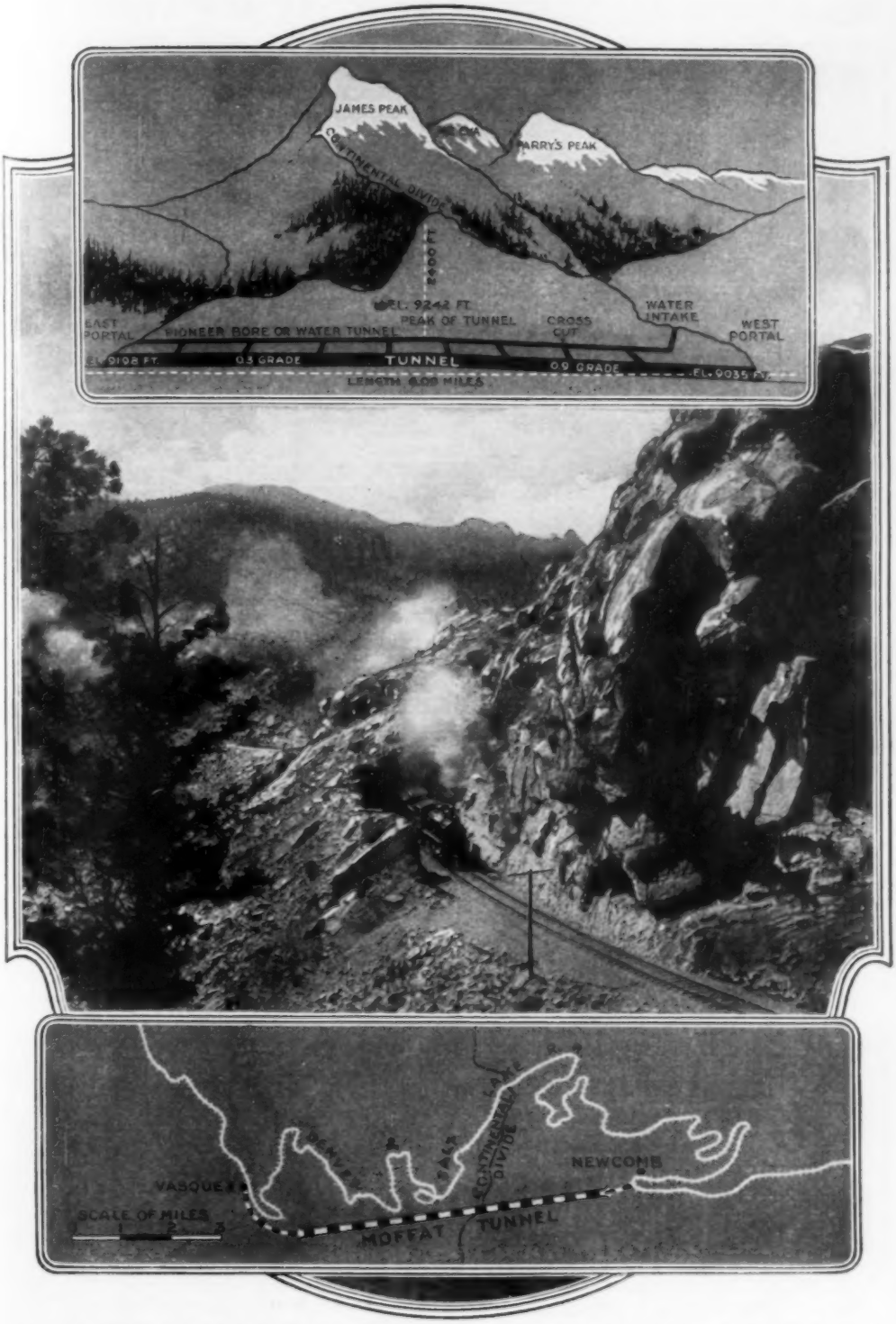
When the tunnel is completed, it will top these treasures and bring them to the doorways of the nation both in east and west.

PIPE BOWL TO SMOKE "CIGAR" KEEPS CLEAN, STAYS LIT

Constructed to smoke tobacco made up in "cartridges" with cigar wrappers, a pipe that has a two-piece bowl is being offered by a mid-west concern. It is claimed that it does not require frequent cleaning, since moisture and nicotine pass into a well in the bottom section where a pad absorbs them. The filler cannot touch the material of the bowl, which keeps the flavor of the tobacco sweet and unaffected, it is said. Air spaces around and below the "pack" are designed to prevent the smoke becoming hot to the taste, and slow-burning qualities insure a light, even when the smoker lays the pipe aside for a short period. The tobacco wads are compressed by machine and are furnished in a box to fit the pocket.

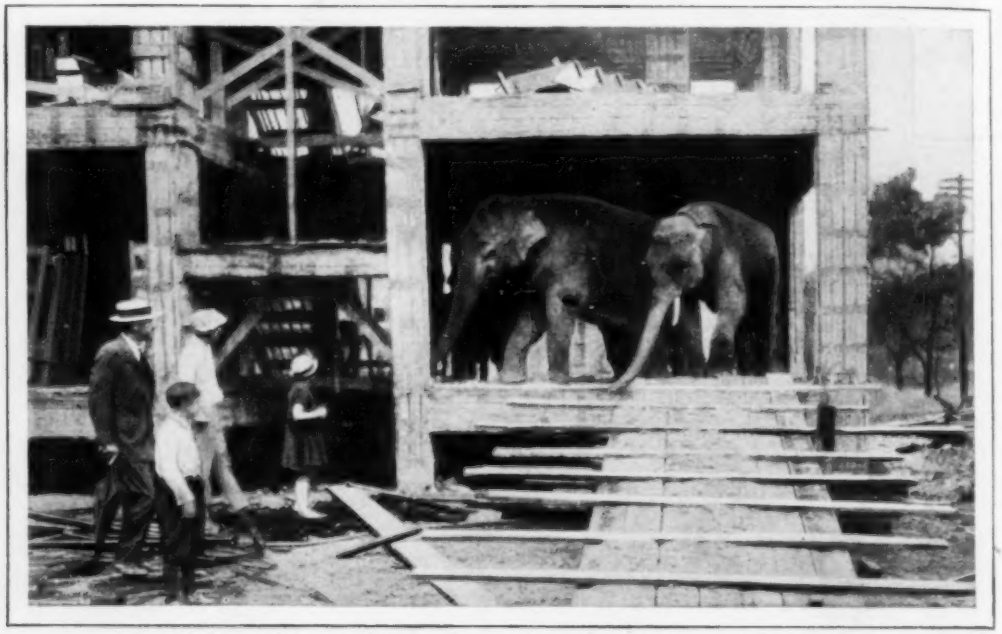
ARTIFICIAL MARBLE SO REAL IT DECEIVES EXPERTS

Although efforts to imitate marble are old, recent improvements have resulted in a product so perfect as to deceive even the eyes of experts. Great care and skill are required in making the artificial product to duplicate the flaws, clouds, and pictures of nature. Ground marble, burnt gypsum, cement, and wax polish are some of the materials employed. Whatever colors are desired are added.



Great Moffat Tunnel that Will Penetrate the Mighty Barrier of the Rockies and Bring Eastward the Riches Lying on the Western Side of the Continental Divide

ELEPHANTS AID BUILDER TEST FLOORS' STRENGTH



Testing Floors of New Building by Having Two Large Elephants Walk Over Them

After completing the floors of an apartment house, a St. Louis inventor of a construction system tested their strength by having two large elephants pass over them. The beasts usually hesitate to tread on any bridgelike structure until they have assured themselves of its ability to support them. The combined weight of the pair was about 7,000 pounds, but they walked through the building without mishap.

TREE TRUNK IS POSTOFFICE FOR ENTIRE COMMUNITY

Covered with letter boxes, a giant tree nas been turned into a postoffice by residents of a small community near New York City. Around the single trunk are grouped twenty-eight depositories from which mail is regularly received or collected. Because of its central location, the spot also serves as an open-air civic center and meeting place.

Getting Mail from Community Postoffice on Tree Trunk that Serves Score of Families

RIVER JORDAN IS HARNESSED TO LIGHT HOLY LAND

All Palestine soon is to be supplied with electricity through the harnessing of the River Jordan. Jerusalem is to have a sanitary system, a lighting plant, and street cars. Great areas of land, at present sterile and arid, are to be reclaimed and made productive. After extensive surveys, a corporation has chosen a site, three miles south of the Sea of Galilee, on which to erect a huge plant, install turbines, and harness the historic River Jordan. It is said that enough power can be generated there to fill nearly every industrial need of the entire country, including electrification of the network of railways.

AIR-SPRING SEAT FOR AUTO BUS INSURES RIDER'S COMFORT

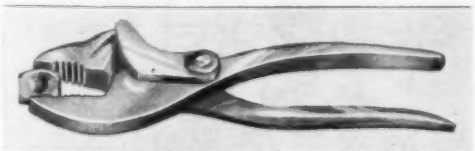
By applying air springs to a parlor car chair for automobiles and motor busses, passengers are insured comfort when the car is passing over rough ground, as the position of the passenger on the seat is not changed materially by the action of the chassis springs. The shock-absorbing device is in a cylinder underneath the seat. The upholstery need not be as heavy as ordinarily is the case. As there is no rubbing between the rider and the back of the seat, the wear on the clothing is reduced.

ONE-HAND WATCH MARKS TIME IN FIVE-MINUTE INTERVALS

Time of day can be learned in a glance at the dial of a one-hand watch, designed by an eastern manufacturer, which shows the hours marked in five-minute intervals. Because of its simple mechanism, it does not easily get out of order. It is especially suited to outdoor use and serves all practical purposes of the two-hand timepiece where periods of less than five minutes are not important to the user. It is easy to set, less confusing, and can be plainly read at night or by nearsighted persons.

GRIP OF PLIERS IS LOCKED BY HANDLE RATCHET

Locking its grip automatically, after securing a hold, a combination of pliers and wrench is in the market. A ratchet arm, attached to one handle, engages the lower side of the opposing jaw. To free the mechanism the clamping device is pushed aside. It can adjust itself to any "nip" within the range of the tool.



Ratchet Pliers that Automatically Lock Their Jaws after They Have Secured a Hold

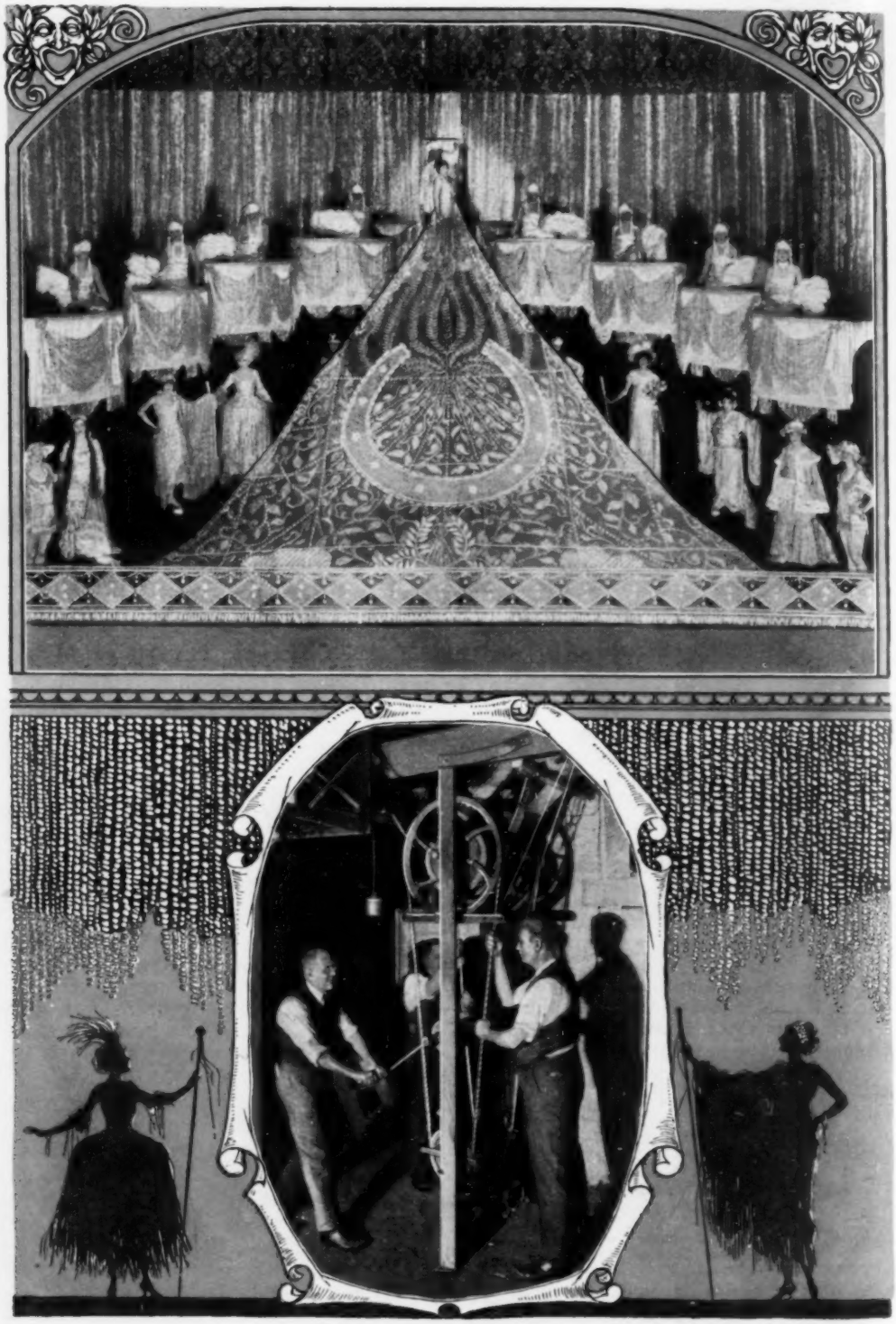
SCIENCE TURNS THE HOLY LAND INTO RICH GARDEN

Orange-growing has become an industry represented by a yearly shipment of a million cases of the fruit in Palestine. Thirty years ago, according to a correspondent of this magazine, hardly more than 3,000 boxes entered the world market from that country. The most modern scientific methods have been applied in the development of what was, a short time ago, an almost barren waste. Big tractors, motor pumps, and deep wells for irrigation have replaced primitive methods. A large packing plant has been built where the product of the trees is sorted and sized. Each orange is polished, wrapped, and placed in an airtight crate, all within a few hours from the time it is plucked. While the coastal lands yield the bulk of the agricultural output, the hills inland are also becoming covered with farms and vineyards. Lemons, apples, and grapes, together with olives and grains, are grown on terraces cut into the hillsides, and bee-raising is carried on in those areas where the land is less responsive to cultivation. Other tracts are sown in cereals to provide food and fodder for the workers and their animals.

Gathering Crop of Oranges in Irrigated Orchard Growing on Level Land of Palestine

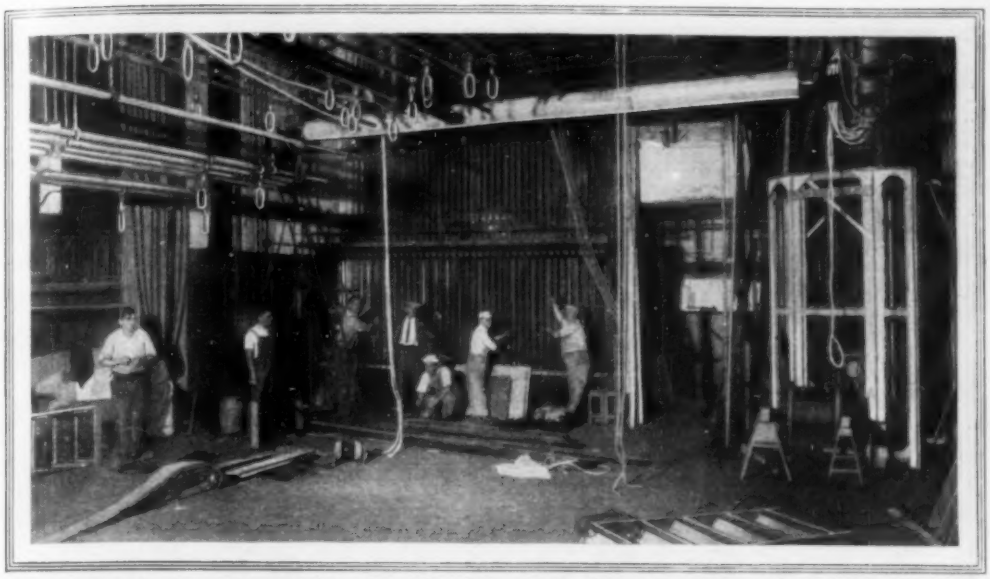
MOVIES MANY CENTURIES OLD

That the Chinese had moving-picture entertainments 3,000 years ago, is said to have been proved by recent investigations. The designs were painted upon long rolls of paper, similar to the films of today. These were slowly drawn through a lantern-like box, and viewed through a slit. An older type was made by arranging cuts on disks strung on an endless string.



Courtesy, Music Box Revue

Above, Appearing to Grow from the Floor, a Crystallike Lace Train Is Unwound from Reels under Stage. Below, Winding in Flexible Floor Strip to Give Passageway for Curtains



Tons of Massive Iron Weights Hidden in a Net of Guy Ropes Control the Balance of Gaudy Curtains and Tinseled Drapes that Lend Sparkle and Splendor to Stageland's Art

Stage Wonders Work of Hidden Toilers

Tinseled Fairylands Rise from Piles of Painted Drapes While Silent Wheels and Brilliant Lights Add Realism to Scene

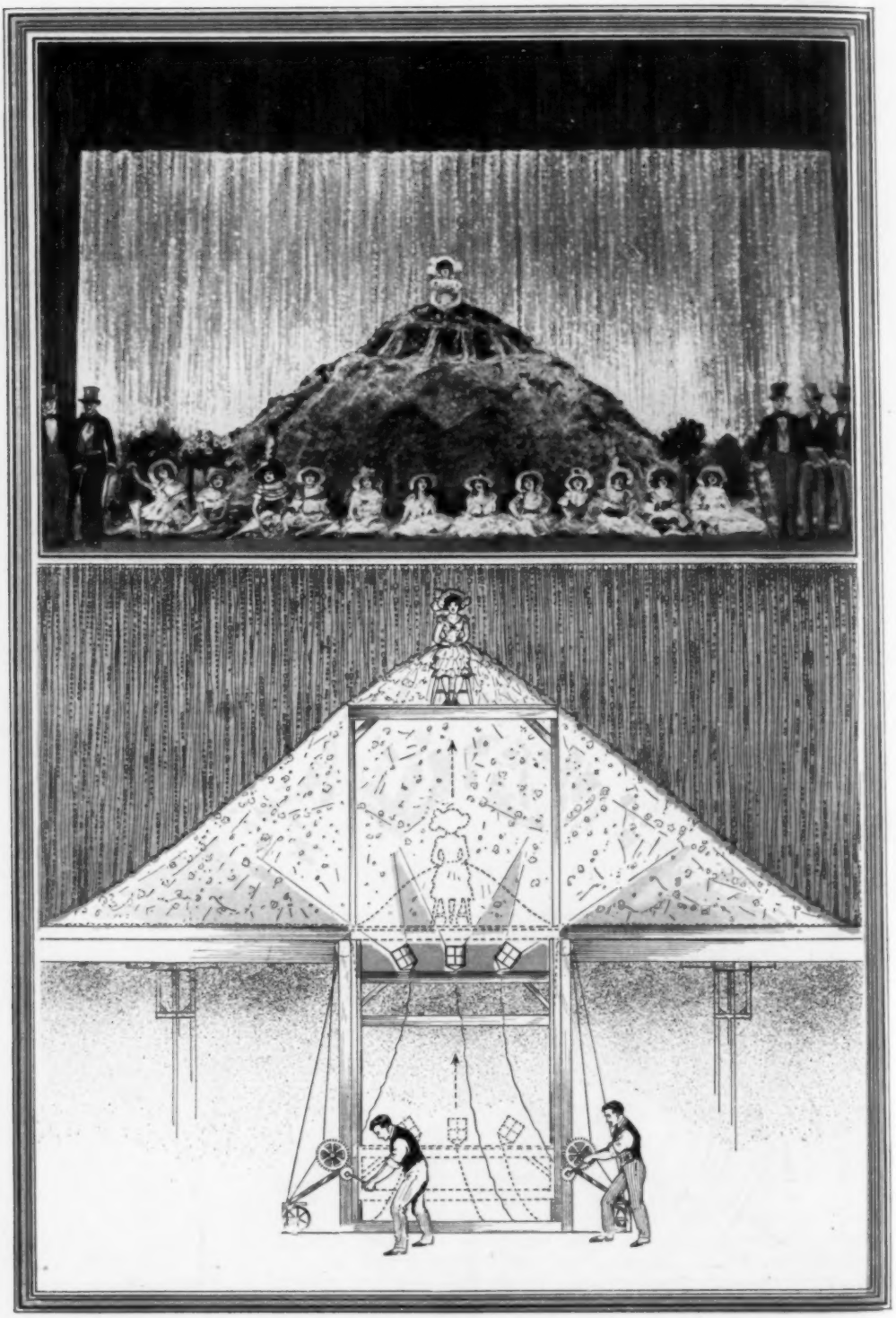
TUCKED far behind the footlights of the stage, twenty-five tons of huge counterweights aid in controlling the movements of acres of spangled drops and curtains in the wonderlands of a production that is resorting to concealed machinery to increase the effects of theatrical arts.

Instead of the usual painted canvas walls that rise and fall from high over the stage, tinseled and bronzed draperies, lacelike net works of metallic cloth, and shimmering fringed curtains are drawn from beneath the floor balanced by weighted chains and ropes. Figures impersonating gaudy birds of the wilds are sent up through the platform on silent elevators, to burst suddenly from the midst of brilliant plumage into rays of light that rival the rainbow hues.

Windlasses and cranks help to carry onto the stage huge striped columns and mounds, which are set in motion at a given signal to the attendants, who operate complicated machines to give revolving motions to the ribboned shafts. When the scene is ended, the mass of cumbersome properties disappear in a twinkling through the stage floor on elevators that convey them to their storage spaces.

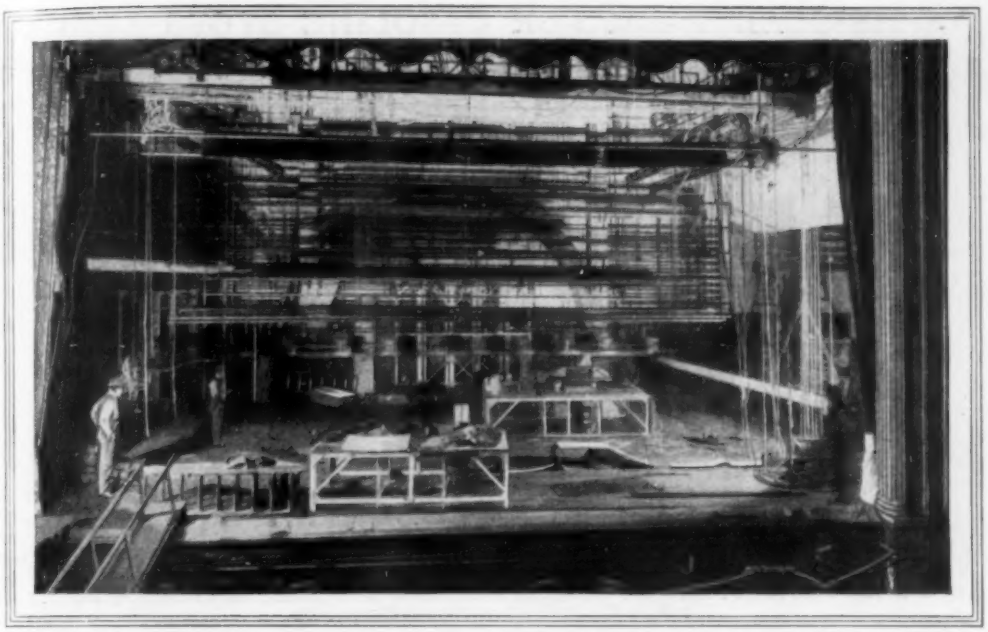
The carpenters' craft is called upon to build up frameworks that support immense burdens, but which are themselves unseen by the audience. Stairways that defy detection afford a means for the actors to ascend to dizzy heights among realistic trees bearing feathery fronds that rival the plumage of the forests. From the depths of their foliage, the songs of birds proceed, in imitation of the noisy denizens of woodlands. To produce such sounds, reedlike whistles are blown by hidden players who stand so that the walls of the structure will direct the notes upward and outward.

Wherever the aid of machinery can accomplish a difficult spectacle, it is ingeniously harnessed to the properties. And with it, myriads of colored lights are fixed to flash and rotate from the mysterious depths of the property room below the fringe of footlights. Sturdy electric motors wind up the reels that carry hundreds of ropes belonging to delicately woven tapestries that seem to hang in midair. Every loop and pulley is familiar to the stage mechanics who are intrusted with the proper releasing of thousands of pounds of materials that rest in frames tied far up in the



Courtesy, Music Box Revue

Above, Wearer of Marvelous Crinoline Gown Raised to Display Its Illuminated Beauty. Below, Elevators Operated Beneath Stage to Lift Platforms that Support Player and Carry Flood Lights



Every Inch of the Modern Stage Is Carefully Planned to Accommodate Its Portion of the Important Mechanical Properties that Help to Form Spectacular Settings of Big Productions

lofty recesses of the "flies." Cues are closely watched, and no movement is made until the signal comes from the directing source. The loosening of a guy line or the throwing of a switch at the wrong moment might result in disaster that would take weeks to repair.

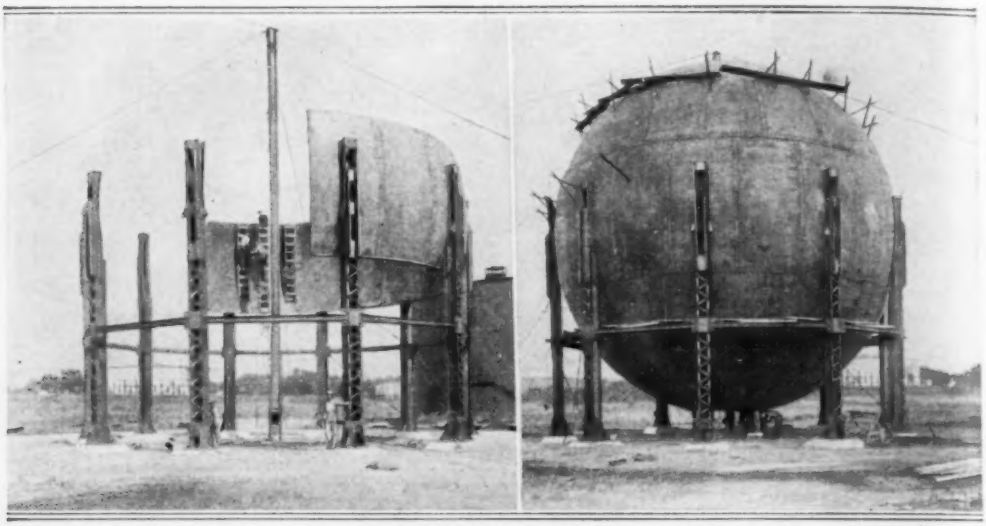
The electric control panel is carefully guarded from careless hands. One or two men are trained in its operation, and during the entire performance they never leave it. Flood lights that illumine the sets are all governed from this central point. After they have been placed by the property men, they are connected to wires leading to the switch panel, so that at all times distribution of light is in the hands of the electricians.

During a principal scene in the Music Box Revue, which employs these arrangements, one of the cast climbs a steep stairway dragging with her an immense train that seems to be attached to her gown. It is so wide and heavy that it is necessary to unwind it from a reel fixed close under the stage, and to attach it to invisible wires passing over pulleys on a steel frame placed at the top of the steps. A windlass manned by a mechanic on the stage level reels the metal rope on a drum, until the marvelous robe stretches the full height and width of the setting.

MAKING PASTE JEWELS GROWS INTO THRIVING BUSINESS

Although the art dates back many centuries, the manufacture of artificial and imitation gems has been stimulated enormously by modern commerce. Synthetic rubies and sapphires set beside real diamonds are not now scorned in the smartest shops. And they are so cunningly made that they bear close comparison with real precious stones. Although the Babylonians, Egyptians and Romans excelled in making paste jewels, the art has been brought to a fine state of perfection only in recent years. A special kind of glass, known as "strass" is used. This is developed by fusing white sand, red lead, borax and several other elements. When a colored gem is desired, pieces are crushed into a fine powder and coloring substances are added. The mixture is then fused and annealed. Cobalt is the coloring used for blue stones, copper for green, gold for red and manganese for purple. Most of the imitations lose their luster in a few months, because their softness causes them to be extensively scratched and acted upon by fumes and air-borne acids.

SPHERICAL TANK FOR GASOLINE STOPS LEAKS

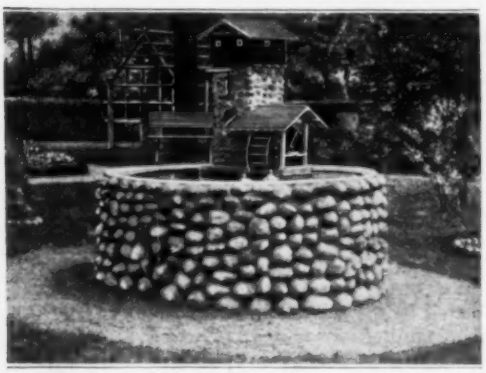


Gasoline Tank Built in the Form of a Globe So that Pressure May Be Equalized, Thus Preventing Distortion and the Consequent Loss through Evaporation

Because of the tendency of gasoline to evaporate quickly, unless stored under pressure, a "leakless" tank has been made in the shape of a sphere to prevent the usual loss. With the ordinary cylindrical container it has been found that the application of pressure tends to bulge out the walls, thus causing the leaks. It is claimed that this tendency is eliminated in the globular form, as the pressure is more equally distributed over the entire sphere. The new-type tank is fifty feet in diameter, weighs 140 tons, and will carry 1,250 tons of gasoline.

BATHING POOL FOR WILD BIRDS MINIATURE OF OLD MILL

Wild birds visiting the grounds surrounding the home of a New Jersey man can enjoy a pool built in imitation of a famous old water mill of the neighborhood. The unique structure stands in the midst of a flower-decked lawn and is made of colored stones collected from many parts of the state. The tiny millwheel revolves under weight of the stream of water that feeds the basin. The top of a tower and the wheel shed are formed from 5,000 small shingles, and 10,000 small nails were used to fasten them in place. Construction of the miniature required about a year, the builder using his spare time.



"Old Mill" Bird Bath Erected for Benefit of Feathered Visitors to the Surrounding Grounds

CONCRETE RAILWAY TIES HAVE WOODEN PLUGS FOR SPIKES

Concrete railway ties, used on a section of a right of way in northwestern India, have proved to resist wear and weather equally as well as wooden ones, according to a report. It is believed their employment will result in great savings of lumber and labor, since they will not require replacing as frequently as the timber. The cement beam consists of two blocks tied together with steel straps. The rails are fastened on by means of spikes driven into treated-wood plugs set in the concrete.

AUTO ON ABANDONED RAILWAY RUNS ON FLANGED WHEELS

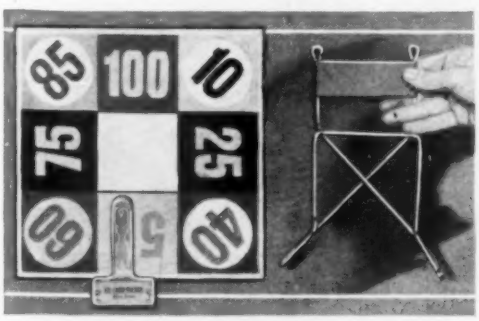
To prevent an entire community from being deprived of railway transportation, a small motor car has been fitted with flanged wheels, to carry passengers over the rails of a short line in Maine. The company has discontinued service over a twelve-mile branch and abandoned it.

PENCIL ON FINGER RING FOLDS IN MOUNTING

Folding into a space beneath the setting, a tiny pencil has been made to be carried in a finger ring. It can be used while the piece of jewelry is being worn, and cannot be detached, as it is fastened to the metal by a hinged joint. A slot in the side of the mounting permits sufficient extension for writing when the point is pulled out, and a new lead can be put in by unscrewing a cap.

WIND-PROOF ICE CARD IS HELD IN PLACE BY SPRING CLIP

For holding the ice card so that wind cannot blow it away, or the wrong figure be turned upward, a strong spring clip has been perfected by a woman who was annoyed repeatedly at the discomfort of losing the card in storms and by its falling from an upper window. The device is made in two styles, a wider spring being better suited to large cards. The holder is fitted with little trouble to porch or window frame, binding the card safely.



Ice Card Held Tightly in Spring Clip, and Larger Style for Big Cards

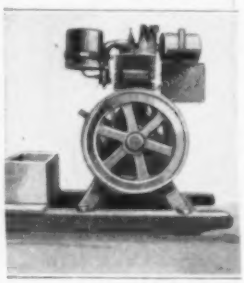
DIRECTION-FINDER FOR RADIO TO POINT WAVE SOURCES

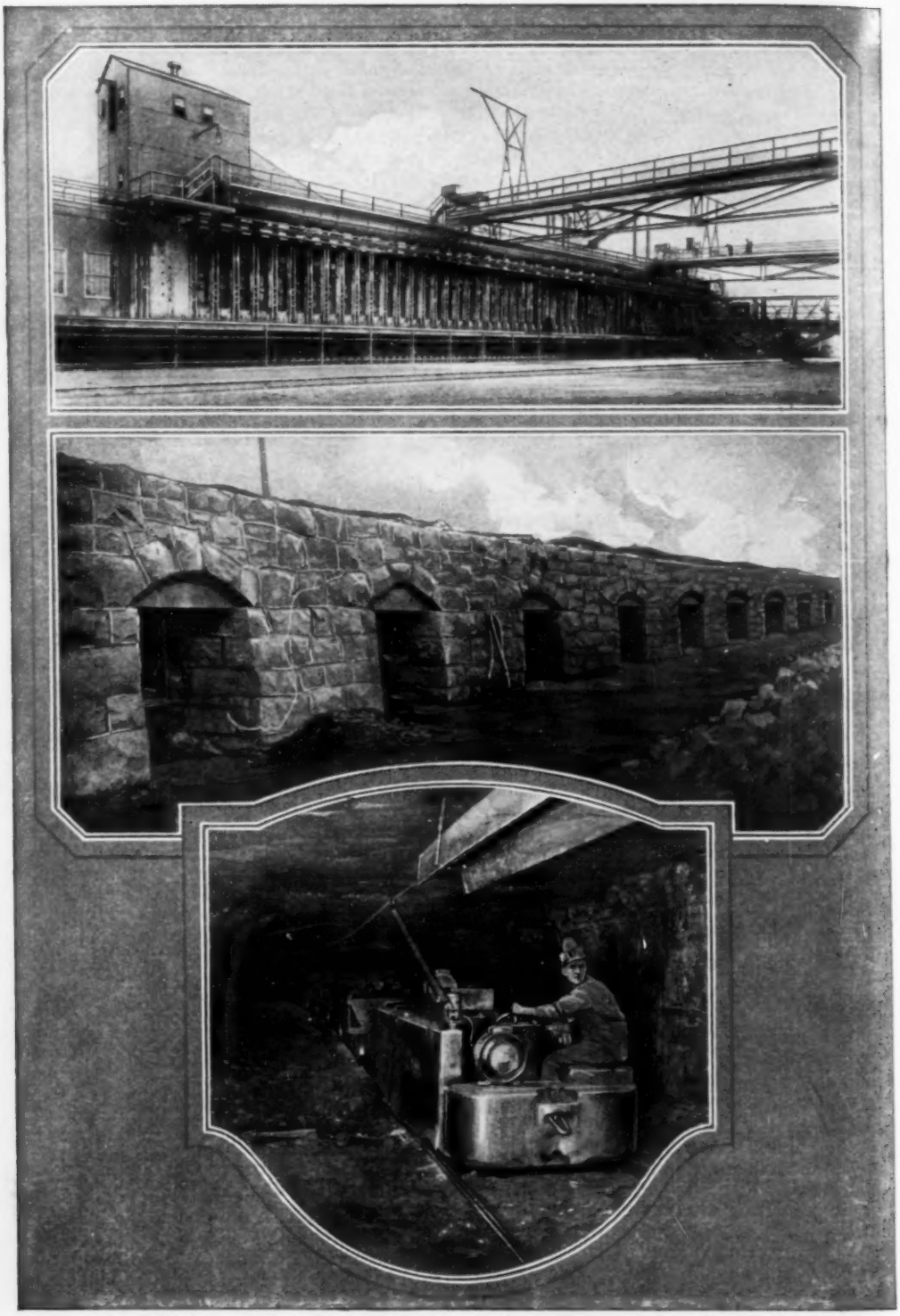
To show the direction from which wireless waves flow, an instrument is being tested that is expected to help in locating broadcasting sources. It also will be of value in aiding distressed sea and air craft which have lost their way, to summon help without the need of technical details of their exact location. In night flying, the location of airplanes could be estimated by the directions from which their radio calls come. The device is undergoing trials on the roof of the hangar that houses the giant dirigible, Shenandoah.

Testing Radio Direction-Finder on Roof of Hangar Occupied by Giant Dirigible, Shenandoah

INCLOSED IGNITION IS PROOF AGAINST BAD WEATHER

Designed for gas engines which are exposed to all sorts of weather, a leak-proof ignition system with all its working parts inclosed within the combustion chamber has been patented by a Canadian inventor. A cast-iron spring, which is not affected by heat, is used. It is said to be noiseless at all speeds, is not hindered by carbon, and because of the absence of cams, bearings, and joints in moving parts all wear is confined to the ignition points and the spring.





Coal Loading Docks, Coke Ovens, and Electric Mine "Mule," Three Links in Great Industry upon which the Nation Is Largely Dependent for Heat and Power

Testing Black Diamonds By the Spoonful

Uncle Sam's Experts Tell Amount of Heat in Fuel from Pinch of Coal Powder in Seeking Substitutes

THERE is no economic question so vitally bound up with the comfort and welfare of the nation as the fuel problem, particularly since anthracite has soared into the luxury class while still remaining a necessity.

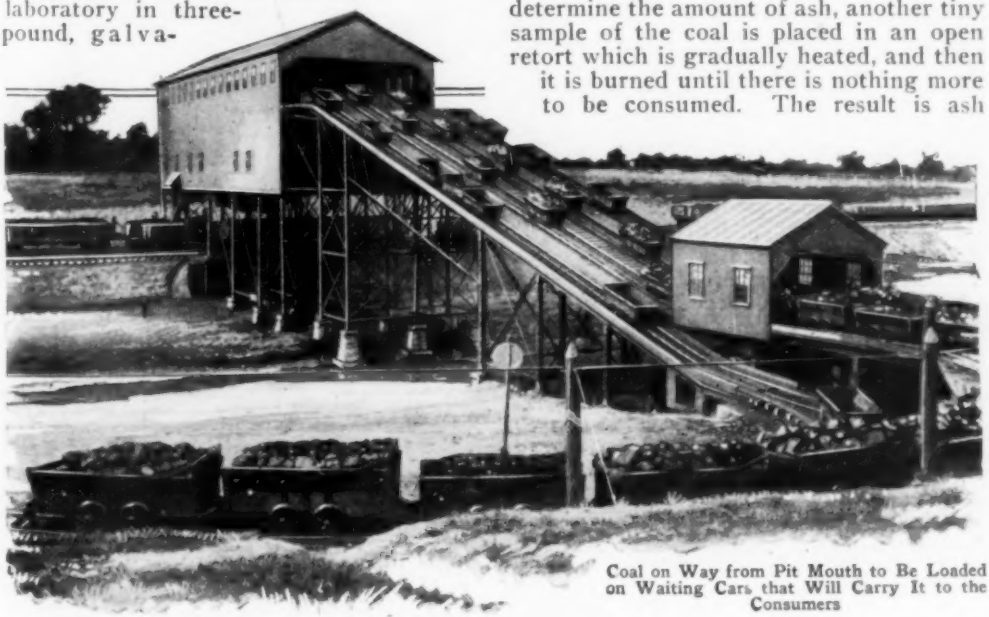
As the supply diminishes, the interest in the heating qualities of hard coal, and the possibility of having to adopt some substitute, have kept this problem in first place in the public mind. Hence, the experiments conducted by the Bureau of Mines, though made only for the government, have been watched with eagerness for any light they might throw upon the fuel question of the householder and factory owner.

At the Pittsburgh experiment station there is a testing furnace forty feet long, with a boiler at one end. Here are used methods by which Uncle Sam's experts can determine from half a teaspoonful of powdered coal, the quantity of heat to be expected from a barge load of the same fuel. Other tests show whether the coal is high or low in worthless moisture, undesirable ash, valuable carbon, or inflammable volatile matter.

For analysis, the black diamond samples are sent into the laboratory in three-pound, galvanized-iron containers with close-fitting screw tops, made moisture proof by being wrapped about the joining of cap and can with electrician's tape. If the coal in the can is coarser than one-fourth inch, it is passed through a jaw-crusher which reduces all of it to one-fourth inch, or finer, and then through a roll-crusher.

Then a number of pans, holding about a thimbleful each, are placed in a drying oven. The temperature is so low that none of the volatile matter is driven off. Superheated air, purified by passing through sulphuric acid, circulates through the oven and carries off the moisture liberated by the heat. Next, the sample is weighed, and, from the loss, the percentage of moisture in the entire lot of coal is determined.

Larger pieces of the fuel are rolled and crushed until they are the equivalent in size of fine gunpowder. This is weighed into a platinum crucible and heated in an electric furnace at a temperature that leaves only a small residue in the form of coke—chiefly ash, and fixed carbon. The volatile matter driven off is the gaseous, combustible part. The carbon represents the similar solid, combustible matter, the latter giving far greater heat units. To determine the amount of ash, another tiny sample of the coal is placed in an open retort which is gradually heated, and then it is burned until there is nothing more to be consumed. The result is ash



Coal on Way from Pit Mouth to Be Loaded on Waiting Cars that Will Carry It to the Consumers

composed of iron, lime silica, and other substances, that cause clinkers in the furnaces and interfere with the perfect combustion.

Later, these magicians, with their tests of coal by the spoonful, determine its heat-giving power, expressed in thermal units, or the amount of heat required to raise the temperature of one pound of water one degree. At first glance this apparatus appears to be merely a tank, about ten feet long, lighted from within by electric bulbs and filled with water actively agitated, in which is placed a number of cans whose tops just reach the surface.

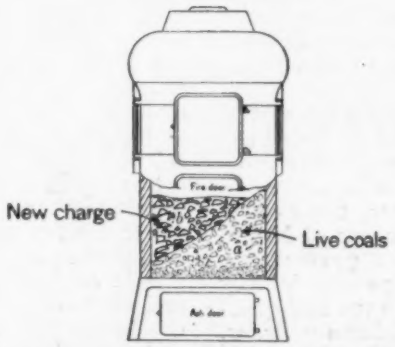
Electric wires attached to glass tubes connect with these cans which contain about four pounds of water, a small propeller blade to keep the contents in motion, and a thermometer.

Most important of all, is a "bomb" in which the actual heat test is made. This is a hollow steel cylinder with walls thick and strong enough to resist a pressure of 800 pounds. This is filled with a pinch of coal dust, and pure oxygen, more than enough to secure the combustion of the fuel, is then forced into it until the pressure is 400 pounds. The "bomb" then is placed in the can and an electric spark is flashed through a tiny fuse wire, igniting the fuel and leaving nothing but the ash. Thermometers give the exact amount of heat produced.

The results of each of these separate tests, for heat, for ash, carbon, moisture, and volatile matter, go back to the desk, where the coal samples were first received. Each one carries the serial number of the sample, and the results are added to the data furnished with the container by the shipper. To give the best results, coal should be low in moisture and ash, high in fixed carbon, but not necessarily rich in volatile matter. The same tests are applied to the various substitutes for anthracite.

When the value of coal as a fuel was first discovered, the demand was so slight and the coalfields so vast, that little or no care was used to prevent waste. Now the demand is so great that Uncle Sam's experts have been experimenting, investigating, and scouring the country for something to offer when the hard coal supply becomes exhausted.

FIRING A RESIDENCE HEATER WITH SOFT COAL



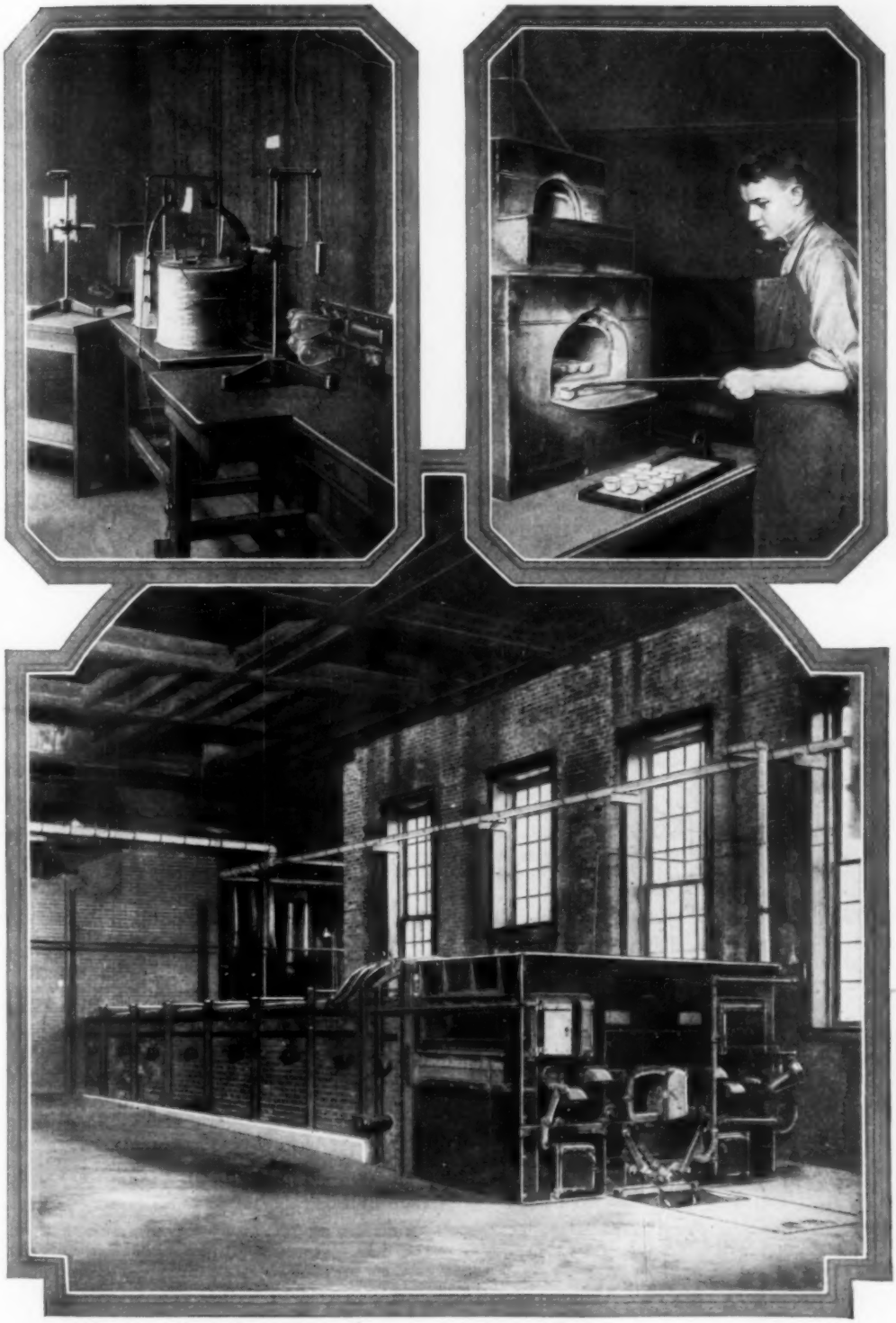
By firing the new charges alternately on one side and then the other, as shown above, less smoke is emitted and the fuel is more completely burned than when the fuel is spread evenly.

Virginia produced recently a small field of semi-anthracite now being developed to capacity. This coal is smokeless and compares favorably with the anthracite, as to heat values and ash content, when properly prepared. It is to be marketed in briquettes and in smaller sizes than the regular anthracite of Pennsylvania. Arkansas, also, has produced a fair grade of coal that is really a product between the regular anthracite and a bituminous coal.

From several standpoints, coke is declared to be the most satisfactory of all fuels next to anthracite, particularly in the matters of cleanliness, smokelessness, and convenience in handling. It is the product left in the beehive ovens as the residue after distillation of certain grades of bituminous. Mixed with small coal, it gives forth most satisfactory heat. An amalgam made of coal dust combined with oil is also on the market and gives a generous supply of heat. Briquettes of anthracite and smokeless bituminous have also been made, but have not come into general use.

Another fuel that for a time gave great promise of abundance in supply in the West is lignite, but, so far, it has not proved the fuel bonanza that was predicted. It is an immature coal that, according to natural processes, requires centuries for its proper maturity.

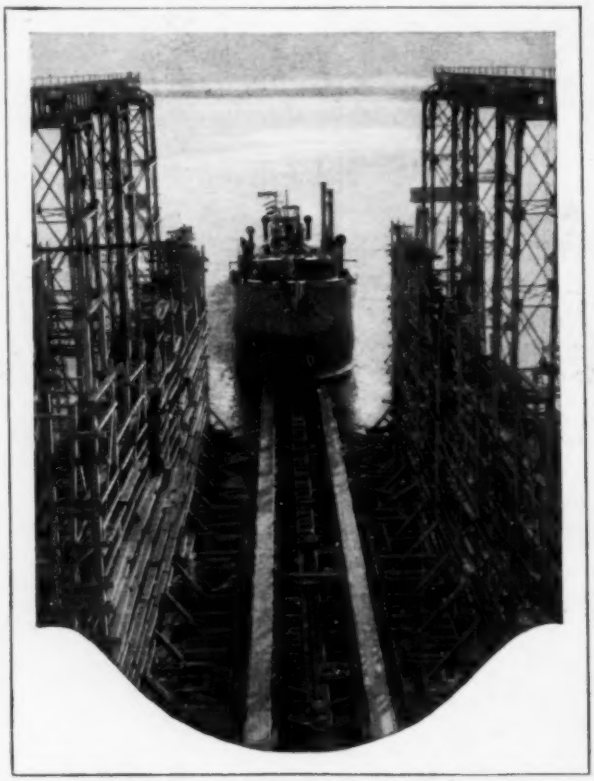
In surveying the coal situation, the conclusions have all been based upon the convenient sizes best known to domestic use, egg, chestnut and pea coal. The smaller fragments have not been considered as hard coal, but as a by-product which has for years been sold as a competitor of bituminous.



Government Coal Testing Apparat in which Pinches of Powdered Fuel Are Forced to Yield Their Secrets so that Amount of Energy May Be Exactly Determined

ELECTRIC SEAGOING DREDGES ARE BUILT BY ARMY

Electrically operated throughout, from propellers to whistles, two seagoing dredges have recently been completed and launched by the army engineer corps for service in keeping harbor channels open. They are the first ships of their kind built, and they are expected to reduce greatly the cost of operation and to prove of increased value because of higher speed and efficiency of the dredging machinery. Power is furnished by large Diesel engines. Electricity is employed for operating all auxiliary apparatus in the ships, for cooking, heating, ventilating, and lighting. The boats' movements are controlled directly from the pilot house, the navigating officer being able to start, stop, change the speed or reverse the engines without signaling below. While similar in appearance to other seagoing vessels, these ships are designed inside on a radically different plan than that of an ordinary steamer. The entire section amidships is occupied by two rows of hoppers, with an open space where sea water is visible. In this "well" is the actual dredging machinery, a large suction pipe attached at one end to an 800-horsepower pump and carrying on the other end, a large casting or "drag" to loosen the bottom as the boat moves slowly along. As the sand and silt are sucked up through the pipe, they are discharged into the hoppers and later carried out to deeper waters, where they are dumped.



An Electrically Operated Ship, a Seagoing Dredge for Harbor Service Being Launched by United States Army

PULLMAN LUXURIES IN AIRSHIP FOR TWENTY PASSENGERS

Passenger accommodations that will rival those of a luxurious steamer, or railroad train, are being fitted into the LZ-126, the Zeppelin now nearing completion in Germany for the United States government. The ship will have space for twenty persons in addition to the crew in the main gondola behind the commander's quarters. The cabins will be fitted up like pullman sleeping car compartments with four beds so arranged that the upper and lower tiers will form seats during the daytime. Folding tables, mirrors, lavatories, and large three-sectioned windows in each cabin also are provided. The kitchen will be lined with aluminum, and all cooking is to be done with electricity. At full power, the ship will have a maximum speed of approximately seventy-six miles an hour, and its cruising rate will be about sixty-seven miles. It will have a radius of nearly 13,500 under normal conditions.

¶Not much larger than a watch, a phonograph which can be slipped into the pocket and has space for ten double disk records has been invented by a Hungarian. The sound produced by the machine is said to be so amplified when it is placed on a tumbler that the tiny instrument can be used to provide music for dancing.

Some of the Ornamental Objects Made by Youthful Students Learning Their Trades in the Cement Shop of the Mooseheart School where all Kinds of Building Materials Are Molded

Schooling Minds to Direct Skill of Hands

Book Learning Taught as Aid and Guide to Youth Trained in Profitable Trades Before Taking up Careers

ONE of the most striking examples of modern education for work with hand and brain is to be seen in the home and school for children at Mooseheart, Illinois.

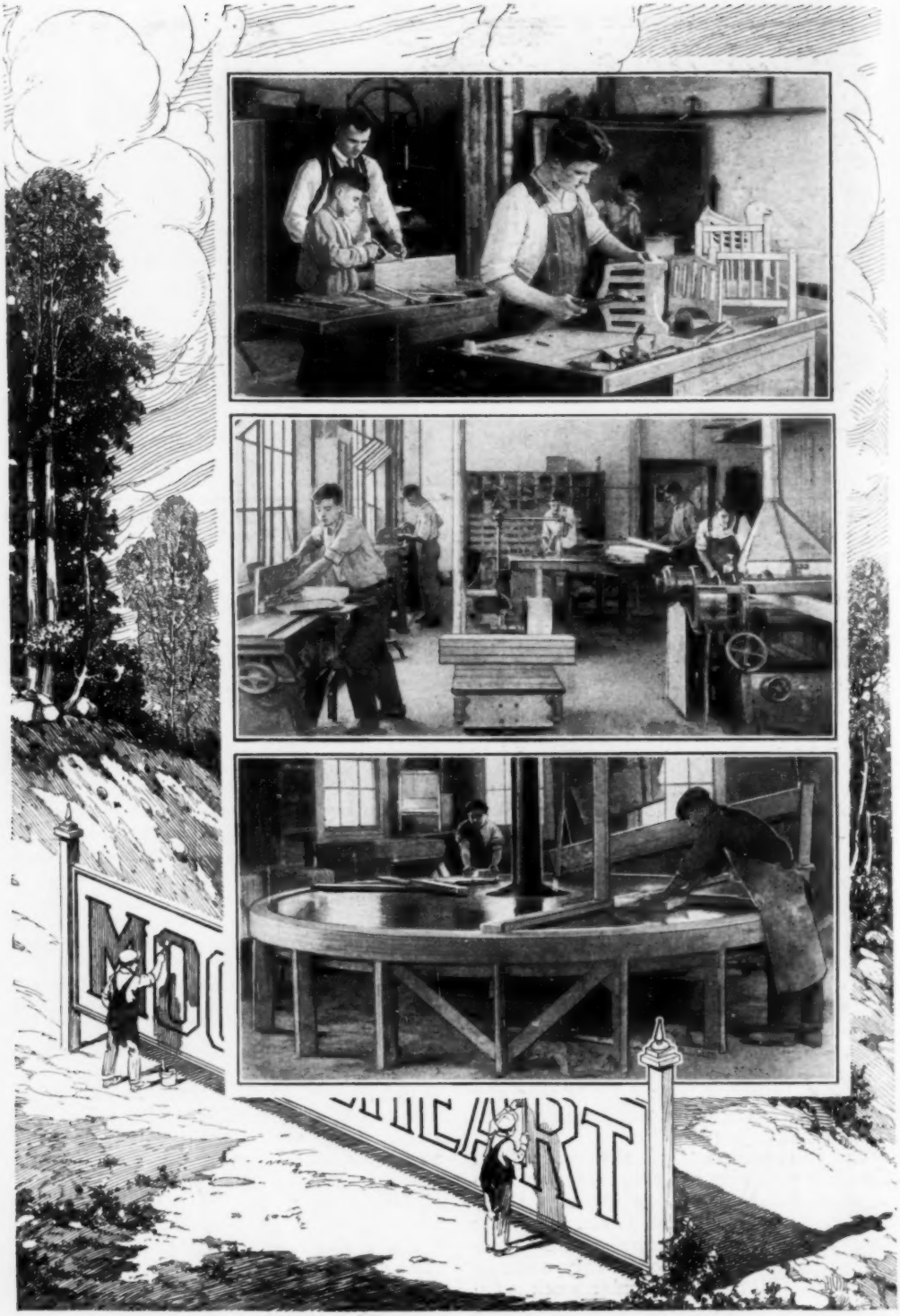
The institution, founded by the Loyal Order of Moose to provide training for dependent orphans of deceased members, is under the direction of highly experienced educators who supervise the studies and direct the home life of the pupils. More than a million dollars are furnished annually to the school for the carrying out of the work. A regularly credited high school, part of the institution, graduates the students ready for college or university, if they prefer; but in every case the scholar is equipped with a trade whereby he can earn his way through life by work of the hands.

Each department of the vocational schools is in charge of skilled teachers who know the trades that are involved thoroughly, and have specialized learning along the lines of their application to the various problems that ordinarily arise in the processes of the particular work. All equipment is of the latest type of tools and machinery. Shop organization is patterned after that in use among the most successful industrial concerns and the most up-to-date practices are followed. The system of organizing, distributing, and routing work is that endorsed by modern factory methods, so that the pupils get training in minor executive lines connected with their actual practice in the trades.

With approximately 1,500 inmates in the establishment, it equals in poulation a fair sized town. And, when all of its utilities and conveniences are included with the territory covered by the buildings, it represents no small demand for the necessities of modern life.

In the machine shop the scholars turn out practically all of the lathe and bench work required by this miniature city, making and repairing tools and farm implements, and producing bolts, nuts, and numerous small parts for the automobile garage and the fleet of cars which is consigned to its care. In addition, some of the heaviest tasks in connection with fixing the machines is performed right on the grounds by the youthful students under the direction of the teachers.

In the carpenter shop, may be seen industrious scholars handling all sorts of job work for Mooseheart, specializing in the



Top, Making Toy Furniture during Pre-Vocational Training; Center, Apprentices in Wood Mill of Carpenter Shop, and, Below, Surfacing Cement Blocks. Bottom, Part of Class in Sign Painting

Teaching Girl Scholars of Mooseheart School to Design and Weave Decorative Baskets as Part of the Training that Provides Them with Useful Knowledge of Profitable Crafts

making of children's furniture for the use of younger wards in the nurseries and kindergartens. Most of such materials are designed by the students, who also produce ornamental articles that are shipped throughout the United States and Canada.

One of the most complete ornamental cement plants is to be seen as a department of the vocational school. All the cement building materials used in the area are here made by the young apprentices. In the grounds are garden seats, urns, bird baths, sun dials and pillars and posts that add a touch of art to their surroundings. All are molded from raw materials in the cement "schoolroom." Many of the articles are sent in great quantities to large stores in New York, Chicago, and other big cities where they are sold. New processes and kinds of cement surface finishes, as well as many new and original designs, have been created in the shop by instructors and students. Its graduates have had pronounced success in finding their ways through big businesses which require services such as they have to offer.

Vocational Student Putting the Finishing Touches on a Cement Urn Made with the Help of His Classmates

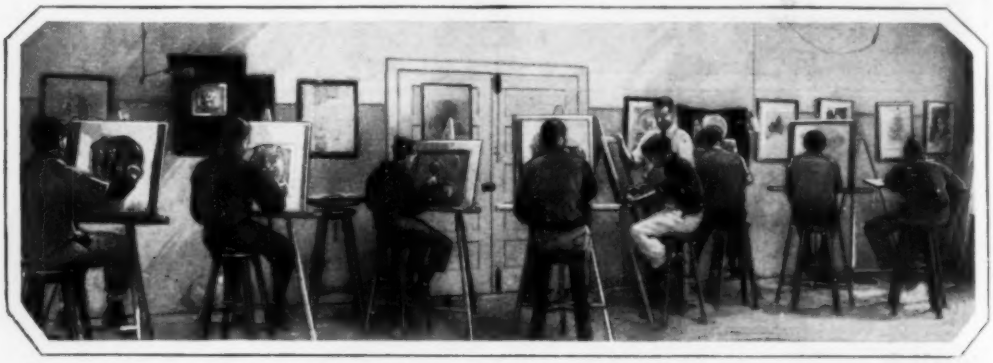
The printery is a modern book, job, and edition plant where numberless copies of all sorts of folders, dodgers, pamphlets, and finely bound volumes are run off. Near by is a sheet metal shop, where all of the ware and supplies of that kind are made up for the use of the school and the home. So widely known has the nursery and landscape gardening department become, that it is said experts from many surrounding states visit the institution for plants and shrubbery grown under the care of the scholars in that branch of the school's learning.

Everywhere is abundant attractive work to invite the youthful mind to labor. Dairy farms are at hand to supply the youngsters and their supervisors with fresh products, and a poultry yard furnishes its share of the necessities even while the student studies the care and raising of domestic fowls. Practical work is found for the boys in the garage, where a knowledge of automobiles and their repair is ready to be spread before the seeker. Paint shops are established to keep the buildings attractive and well-appearing, and here a course in the trade is available, coupled with

training in sign-painting and decorating.

Girls at Mooseheart are taught dressmaking and become expert in household management and the domestic arts. If they are inclined to other lines of effort, they can learn stenography, general office work or nursing. Many of them have taken up the profession of teaching.

Only about one-fourth of the graduates of Mooseheart choose to go on with higher studies in colleges and universities, using their vocational training in the trades of industry to earn their ways through the courses. Sometimes they go in for engineering and chemistry, but in every case they are so educated that either hand or brain can be employed to finance their studies.



Modeling Class of Boys where Sketched Designs Are Copied in Relief in the Form of Panels and Insets to Be Mounted on Artistic Objects of Cement Work

During their stay at the school, the scholars are taught the value of a proper amount of recreation. Within the limits of the grounds are woods and streams where delightful pastime is afforded. In season, the boys go trapping along the river for small fur-bearing animals that invariably find a ready market in the vicinity of the place. Agriculture and its interesting revelations attract quite a large number of the scholars to that study and with graduation from the high school, it is further pursued in higher courses at the colleges or universities of the country.

The school runs all year round. Vacations are included in the work of the pupils, for everything is provided for summer camps, canoeing, swimming, and fishing in the lakes and streams. Athletic fields are layed out and at least two hours each day are spent in physical exercise that is directed by competent instructors.

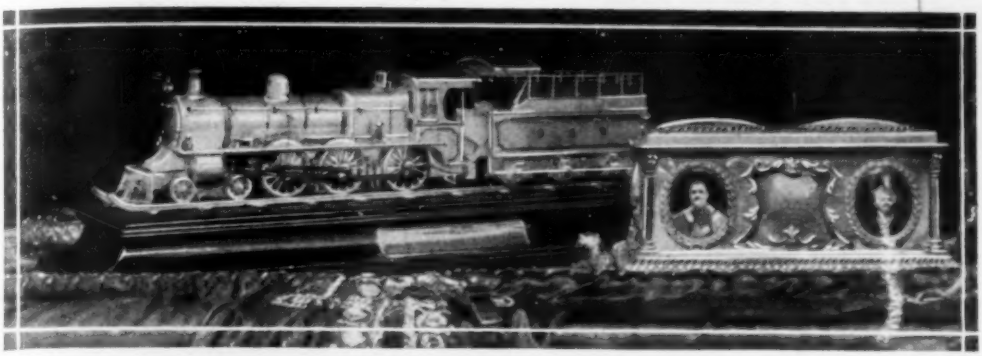
Classes in art work are held for both boy and girl students, whereby they can get a foundation from which to extend their pursuits in such training. Not only painting, such as landscapes, and pencil sketching are taught, but clay molding in decorative subjects and similar work in bas relief are practiced. Dress design and the making of artistically colored ornamental articles are among the special studies arranged for the girls.

When the charges reach the age of twelve years, they are put to work on a three-months' pre-vocational study as a test period to permit the scholars to select the trades in which they desire to specialize. More than ten such courses for the boys and an equal number for girls are available. The actual work on the study does not begin until the tenth grade of the educational course has been reached. The vocational subjects are taught, at first, only an hour and a half a day, taking turn with the other studies necessary to prepare the youthful apprentices for proper training in the application of schoolroom knowledge to the crafts that equip them for profitable careers.

FLOUR MADE OF SUGAR BEETS IS SUITABLE FOR BAKING

Flour suitable for baking cakes and sweet bread, and said to be of high food value, is being manufactured in France from dried sugar beets. Water, which forms approximately seventy-two per cent of the bulk of the vegetables, is first evaporated by chopping them into small pieces and subjecting them to intense heat. From 375 pounds of raw beets, 100 pounds of dried material is obtained. This is then ground into a fine meal. The large amount of sugar is declared to adapt the substance especially to baking cakes and puddings, and, because of the high temperature to which the beets are exposed, the flour is said to be entirely free from germs.

SILVER GIFTS SHOW SKILL OF INDIAN CRAFTSMEN



Unique Tokens Fashioned from Beaten Silver Lavishly Decorated and Modeled by India's Skilled Metal Workers to Show the People's Regard for a Retiring Province Governor

Skilled Indian silversmiths, world famous for their cunning in fashioning beaten ware, exercised their ingenuity recently in making gifts to present to an outgoing governor of Bombay, Sir George Lloyd. A cask, incense burners, and a model of a locomotive on one of the state railways, each polished, engraved, and embellished with elaborate designs were molded from metal as expressions of the regard of the citizens for the official. The pieces reflected the high efficiency the Indian craftsmen have attained. Beaten work of gold and silver that adorns their temples is among the finest examples of the art in the world.

SAND FOR RAILROADS' SAFETY COSTS MILLIONS YEARLY

While big figures are used in telling the cost of safety to the railways, the amazing item to the average person is the amount spent for sand. Four tons are required for every mile of road in the United States, according to the figures of one trunk line with 7,500 miles of track. As this road is in the middle west and south, where mountains are not encountered, the figures given are regarded as conservative. The cost of putting the sand into the engine box is placed at $2.50 a ton as an average minimum. For all the roads, the yearly cost is estimated at $2,637,070. For the most part the sand is brought from river bottoms and dried by waste steam at the round house.

TONS OF ALASKA EAGLES SLAIN AS PROTECTION TO FISH

Because they are said to prey on salmon and other valuable fishes, about 150 tons of bald eagles are reported to have been killed in Alaska during the past six years. While bounties are offered for their extinction, experts claim that little damage is done by these kings of the air. After spawning, it is said, the salmon die, and it is upon the spawned-out ones that the huge birds mainly feed. Depletion of the herds of desirable forest animals and other wild fowl also is charged to the eagles. The number of the feathered giants slain since a law against them was passed, it is estimated, would cover a strip of ground thirty-three miles long, if they were stretched out with wings extended.

OLIVE OIL LURES TINY ANTS TO DEATH IN BOTTLE

Attracted by a bottle of olive oil, after they had infested the upper floors of a steel and concrete building, tiny red ants dug a path at the side of the cork to reach the fluid. The insects first found a small hole in the stopper from which they started their "tunnel." After gaining the inside, they were unable to escape, and fell into the liquid and died. The vial was kept in an office on the seventh floor of the structure, where the pests found it.

FORTY-TON ROCK ON ROLLERS MOVED THREE MILES

Resting on a platform that moved on wooden rollers and tracks, a huge boulder, weighing more than forty tons was hauled over a state highway in Massachusetts to a park, where it will be used as a monument. Heavy cables wound by windlasses pulled the rock, and the timbers and round pins were carried ahead after the big burden passed over them. On one side of the stone is a large, flat surface on which it lay during the journey. To this level face will be attached a bronze panel to explain the purpose of the boulder.

Giant Boulder Being Moved along a Highway on Its Three-Mile Journey to a Park

BRICK DUG FROM RUINS TELLS OF MOST ANCIENT EMPIRE

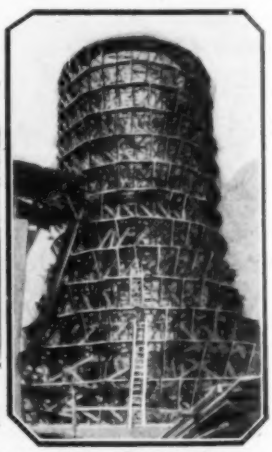
Dealing with events 2,100 years before the Christian era, an inscribed brick has been found in the ruins of Kish, capital of one of the first empires. The excavations, which have been carried on by an expedition in Mesopotamia, revealed the remains of a lofty tower, that, according to the lettering, was rebuilt more than 4,000 years ago. It is predicted that, with the opening of other chambers, written history, seventy centuries old, may be discovered. The searchers believe that stories of the flood spoken of by the Bible will be confirmed by records lying in the library of the ruined temple.

IRON BURNER FALLS WHEN HEATED ON ONE SIDE

Excessive heat, applied to only one side of a tall, sheet-iron refuse burner in a western lumber mill, caused the huge walls to buckle and collapse. Investigation showed that a large quantity of sawdust and lumber scraps had collected on one side of the burner and close to the metal wall. This became overheated when the rubbish was ignited, and, softening under the high temperature, finally collapsed under the weight from above. The burner was built on a concrete base seventy feet in diameter and was more than 100 feet high. An air space had been left between the double walls, but proved insufficient to prevent the unusual accident.

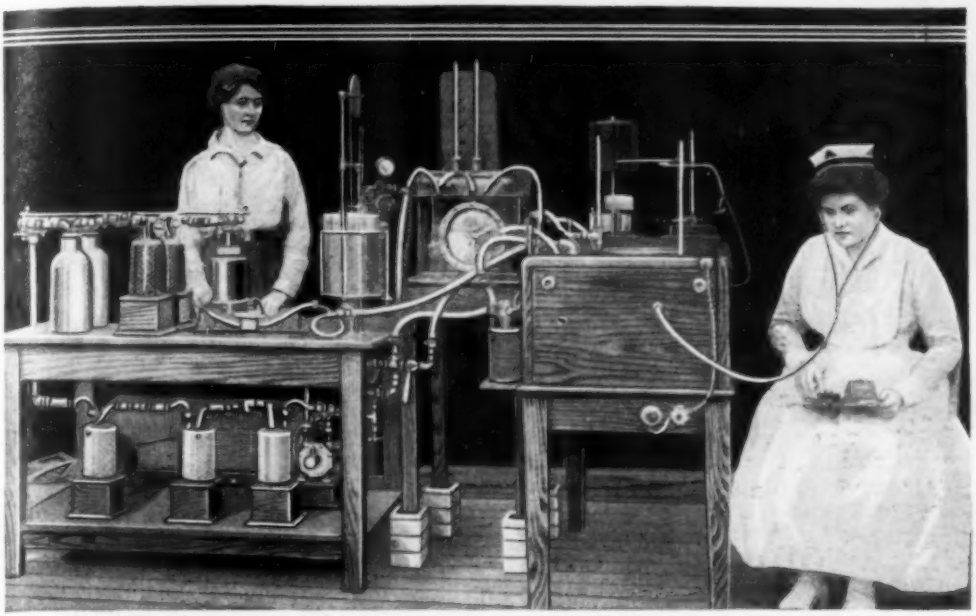
Burner Completed

What Heat on One Side of Interior Did to Huge Burner the Walls of Which Were of Iron



Under Construction

"FUEL" NEEDED BY HUMAN BODY TOLD BY ITS HEAT



Instruments that Measure the Heat Production of the Human Body and Register Activity of the Pulse to Tell Amount of Food Needed to Replace Expended Energy

For measuring the needs of the body for food, a device has been made which registers the amount of heat produced by the human system. Children are tested at intervals of two or three months for the first four years of life in order to gauge the energy they consume. Nourishment required by them is estimated from the volume of heat generated by their bodies in ordinary activity. Men and women are subjected to similar experiments to learn their minimum food needs to offset the expenditures of strength in every-day movements. Infants are placed in a chamber where instruments show the supply of air breathed and measure the carbon exhaled. Even while asleep, the activities of babies' bodies can be studied and their "fuel" requirements told.

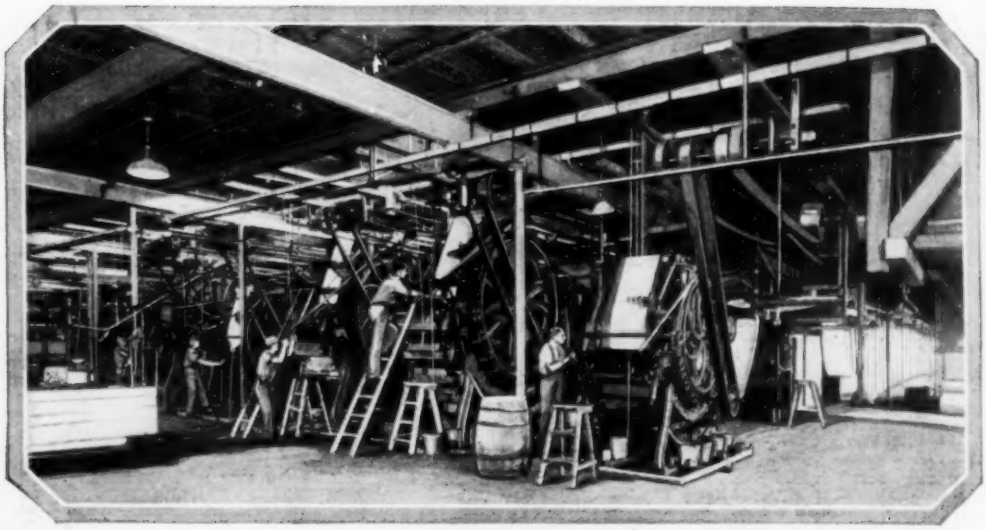
COAL IS SAVED BY AIR DRAWN DOWN HUNDRED-FOOT STACK

Owing to the shortage of coal, German engineers have made an investigation of the fuel problem, the results of which showed that the air in the neighborhood of steel works is much drier at a height of a hundred feet than at the ground level. This is due, it was said, to the great amount of heat dissipated by the furnaces and boilers. In making steel, it was found, dry air needs less coal than damp air for combustion, and so large suction towers were erected through which the air needed for the blast furnaces was drawn. It is estimated that many thousands of tons of coal were saved in consequence, one pound of water eliminated from the air saving three tons of fuel.

WASHER WITH SPONGE SPRAY PROTECTS AUTO FINISH

Removing dirt and grit from the sponge as fast as they collect, a spray washer, especially suited to polishing automobiles, has been made. A continuous stream of water flows through a long, hollow nozzle

and into the sponge. With this device, it is easy to reach underneath or on top of the car, and, because the swab is always free of sediment, the finish is less likely to be marred. The tubing is covered with rubber, so it will not scratch polished surfaces. It also will clean windows.



Battery of Presses Turning Out Endless Streams of Wallpaper

From the Stone Age to Wallpaper

Patterns of Today Reflect Designs, Coats of Arms and Tapestries First Used During the Middle Ages in Europe

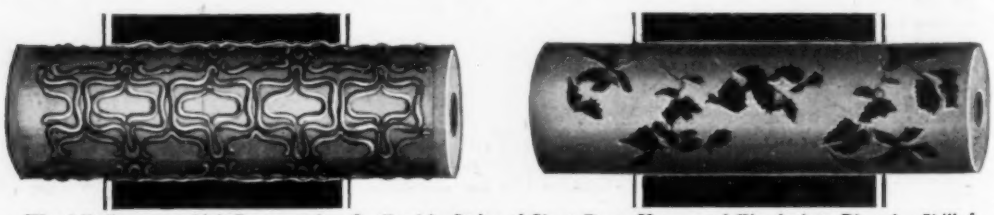
ALTHOUGH the manufacture of wallpapers is one of the most interesting branches of the paper industry, comparatively few persons are familiar with its details or with how its development has kept pace with the progress of mankind from the earliest ages.

In the modern mill waste paper of various kinds—catalogue trimmings, office records and overissue newspapers—is reduced to pulp together with a certain amount of chemical, coloring matter and sizing. Since the output of this process does not have the color or texture necessary for the background, a coating of china clay, or plain ground color, is applied before printing.

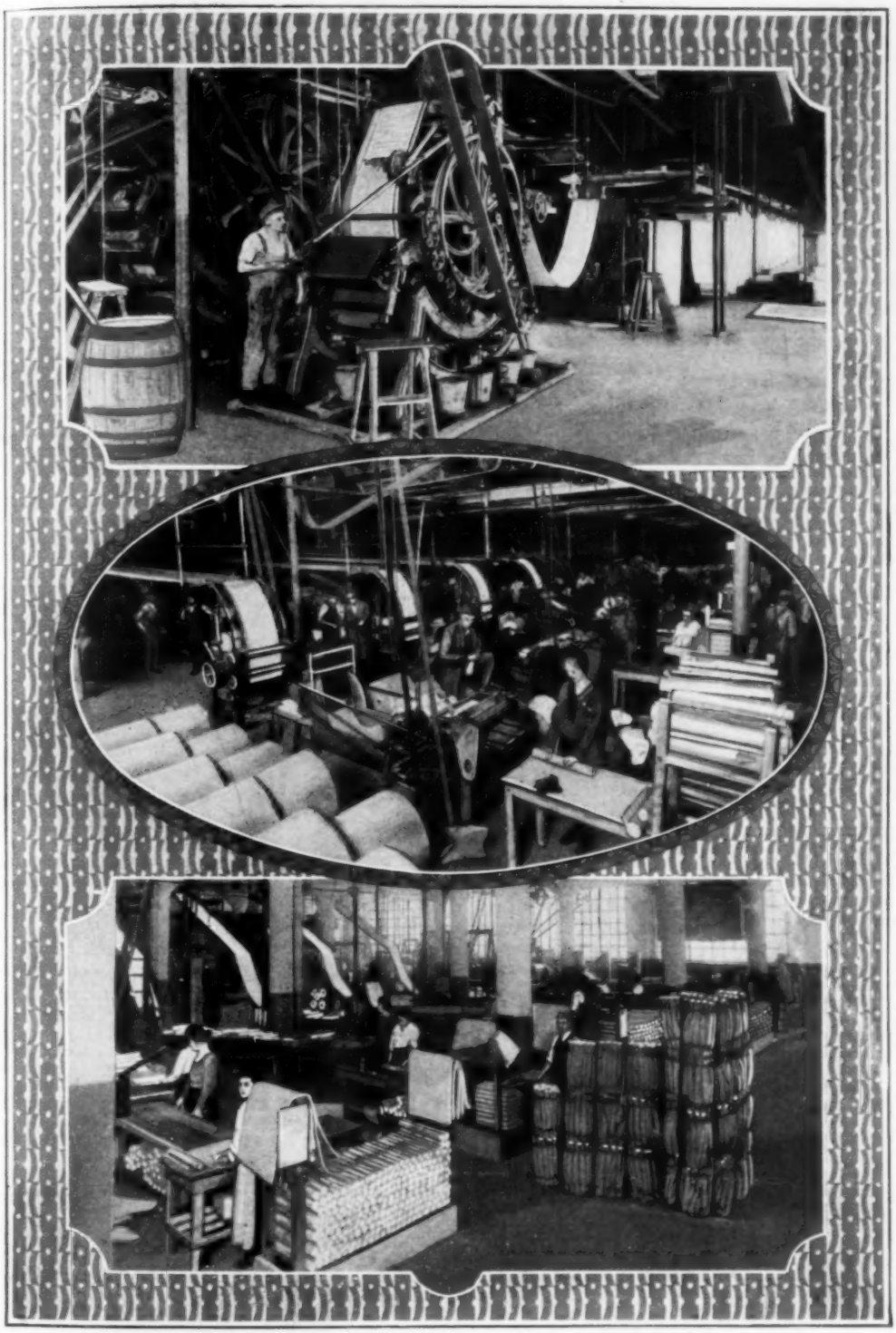
Then patterns are selected and a careful count is made of the colors involved. Many fine papers have eight hues and some even have twelve. This number and the grades of color largely determine the price at which the finished product is sold.

In general appearance, the printing machines resemble those used in textile mills. There is a great difference, however, in the rolls. For wallpaper, these consist of maple with the designs outlined in strips of sheet brass. From the original pattern prepared by the artist, a series of transfers are made—one for each color.

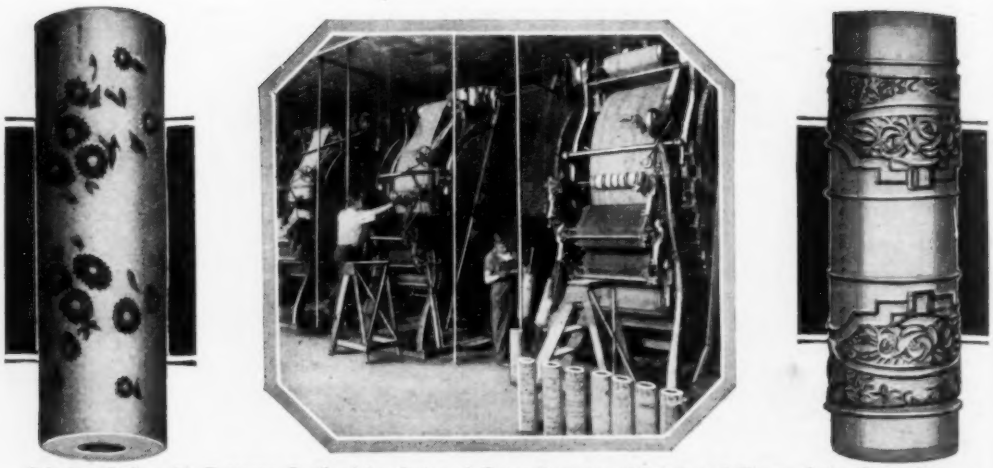
These are then traced on the wooden rolls and skilled workmen proceed to cut lengths of sheet brass strips, bend them to conform with the curves of the design and then hammer them firmly into the surface of the roll. Where solid masses of color are required, the spaces between the strips are filled in with specially prepared felt. When the design has been completed, the



Wood Rolls upon which Patterns Are Outlined in Strips of Sheet Brass Hammered Firmly into Place by Skilled Craftsmen, the Spaces Being Filled with Prepared Felt



After Passing through the Great Printing Machines where Every Roll Adds Its Separate Color, the Wall-paper Is Dried, Sorted and Wrapped in Preparation for Shipment



Printing Rolls with Patterns Outlined by Strips of Brass Packed with Felt and Three of the Great Presses which Resemble Those Used in Textile Mills

surface formed by the protecting strips is ground in a lathe until uniform, so that it will print evenly.

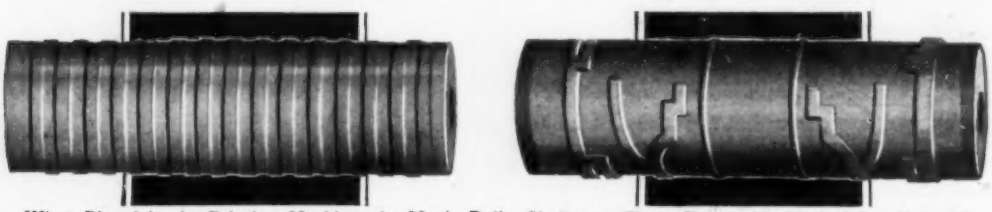
Paper is fed to the machines from a reel just in front of which is a short belt conveyor. Several yards of paper are carried on this in the form of loose folds, giving sufficient leeway to permit change of rolls without stopping the press. Passing through the printer, each roll contributes its particular color. As the paper emerges bearing the complete design, it is picked up by a series of moving space bars and carried in short festoons underneath a duct from which warm dry air issues.

With some patterns, this completes the process. In others, however, subdued effects are produced by overprinting the whole design with a sort of screen, usually in white. Embossed effects also may be obtained by running the paper between rollers having raised surfaces. Special papers include oatmeals and varnished tile. The surface of the former consists of colored or tinted stock containing comparatively fine particles of sawdust. In the latter, the design is printed from engraved rollers and the entire surface is coated with transparent spirit varnish.

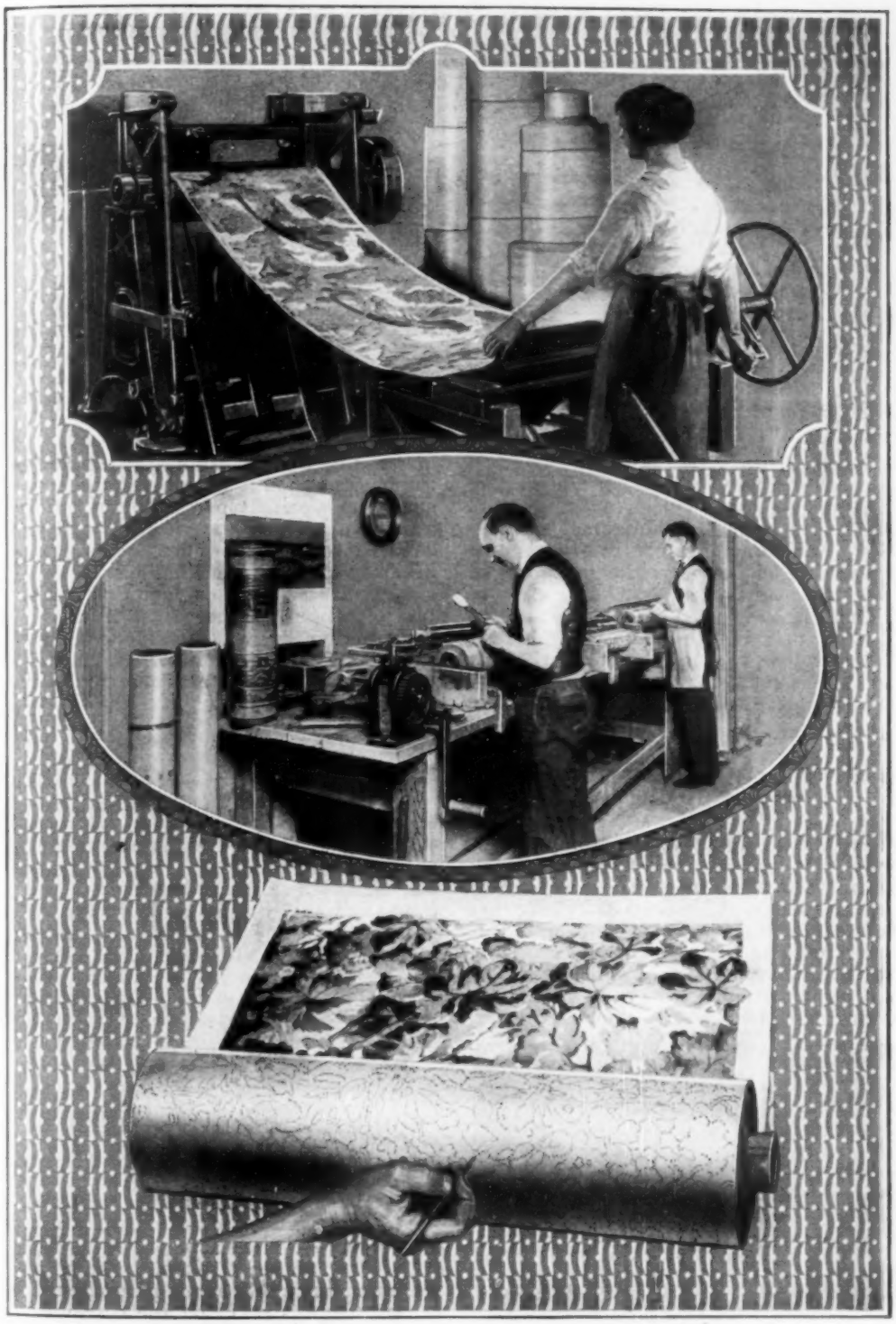
In its use in modern homes, wallpaper resulted from the demand for refinement and comfort. In the earlier days the entire household, servants, and all, lived in the "great hall." Then the need for more privacy was felt as culture developed, and the "with-drawing room" was introduced for the women of the house. From this term the modern word "drawing-room" is derived. The knights who took part in the crusades were so completely inclosed in armor as to be unrecognizable. In order to establish their identity, each one adopted a distinguishing emblem, which was painted on their shield and embroidered on their surtout, or outer coat. When they returned from the campaign they hung their shields and helmets on the walls of their castles, and these made such decorative effects that along came the interior decorator who elaborated on the idea and painted these devices on the walls, which also were adorned with handworked tapestries.

Among the motifs used were floral and animal forms—fruit tied in bunches with leaves and flowers and festoons.

And so today, these same patterns are found in exterior and interior decoration everywhere, and in wallpapers they are in constant evidence.

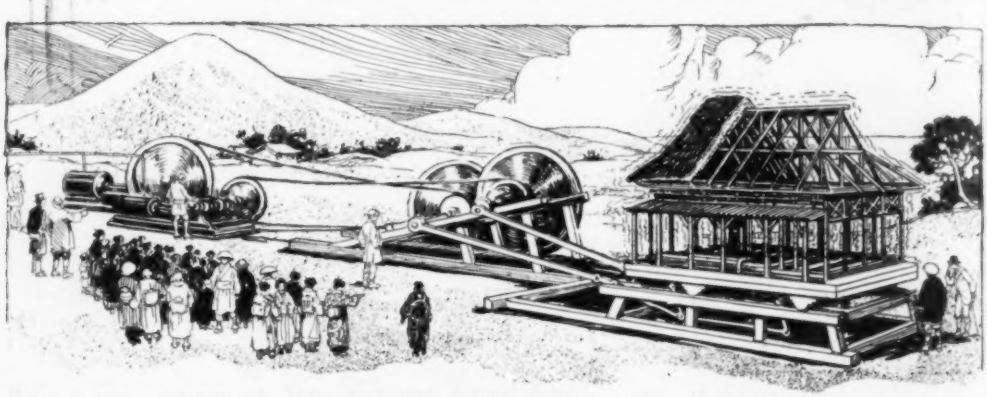


When Placed in the Printing Machine, the Maple Rolls, Similar to Those Shown Above, Are Supplied with Ink by Means of a Short Felt Band



Wallpaper Coming through Embossing Rolls (at Top); Transferring Artist's Designs to Printing Rolls (Bottom), and Hammering Strips of Brass into Maple Cylinders (in Center)

MAN-MADE QUAKES TEST BUILDING'S STABILITY

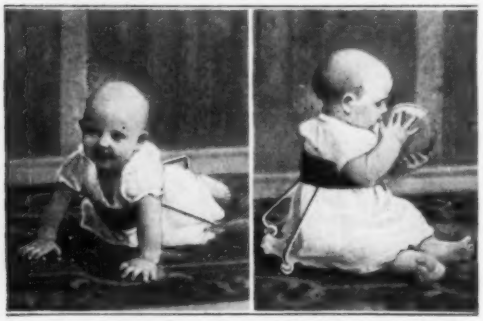


Trying to Shake a Building to Pieces with a "Quake-Maker" that Produces with Varying Intensity Vibrations of a Real Earthquake on a Moving Platform

Tests to determine the type of building best adapted to withstand earthquakes are made on a machine which reproduces, with realistic intensity, the horizontal and vertical vibrations caused by a genuine tremor. The device is the invention of two Japanese professors, and consists of a platform on which a model house is constructed on a reduced scale. The base is then made to sway and shake as the surface of the earth does in a seismic disturbance, by means of levers. The longer the house is able to withstand the vibrations, the better suited it is to resist the earthquake's power. Results of the recent disaster and of many previous occurrences like it, have proved that fires, gaining rapid headway in crumbled buildings, have frequently caused more damage than the actual vibrations of the earth. A type of construction that will be immune in heavy shocks is sought by builders in countries where such disturbances are likely to occur.

BELT ALLOWS BABY TO CRAWL BUT PREVENTS FALLS

To protect infants from falling, a belt with wire legs has been invented, which allows them to sit or crawl about in comfort and safety. It consists of a girdle that is laced about the waist. Attached to this are three wire legs, which hold the child upright when in a sitting posture, but offer no obstruction when it desires to crawl about the floor.



Belt Adjusted; the Legs Prop the Infant Up to Prevent Falling Backwards

ENAMEL FROM COTTON RESISTS HEAT AND DRIES RAPIDLY

After many years of experimentation, chemists have developed a finish for wood and metal which, it is claimed, is so durable, tough and hard that it will resist high degrees of heat, hot or cold liquids and hot plates or dishes. It is described also as absolutely waterproof. This enamel is now in use in many wood and metal working industries, including the manufacture of automobiles and furniture. It is made from a solution developed from cotton.

DOG HAIR WOVEN INTO CLOTH

To demonstrate the value of its beautiful, white coat as raw material for weaving cloth, a Samoyed dog, a species best known in the Arctic circle, was exhibited at a lecture of the Royal Society of Arts in London. The hair used is from the combings—the undercoat that comes naturally twice a year. It was said that the commercial possibilities of garments made from this product have been proved.

SMOKE SCREEN TEST OF SAILS TO HELP 'PLANE DESIGN

From the study of the action of a smoke screen on the sails of a boat in an effort to gain increased speed, improvements in the wing design of airplanes are expected. The action of the smoke was photographed with a slow motion picture camera so that the flow of air and its effect could be studied. One instance in which aeronautical experience already has been used by yacht designers is in the cutting down the resistance of rigging. In the latest Shamrock, a fabric sleeve was fitted around the mast to carry the outline smoothly into the line of the sail. It has also been suggested that a rigid sail, modeled after an airplane wing, would result in greater speed, but practical difficulties in construction were declared to make its general adoption unlikely.

STORE DROPS SEVERAL FEET, BUT BUSINESS CONTINUES

Defects in the shoring under the foundation of a concrete grocery store caused the structure to settle several feet to a steep angle while it was being moved recently. By rigging improvised steps, the proprietor

Even Windows Didn't Break When This Concrete Store Building Tilted on Its Side

was able to conduct "business as usual" until the building was righted. Because of the rigid construction and comparatively light weight of the store, it was damaged only slightly by the accident, even the large window panes withstanding the shock.

¶ Hawaii is reported to have more than twice as many motor cars and trucks as there are in the whole of China.

RAILROAD BICYCLE AIDS GUARD TO FIGHT FOREST FIRES

To enable members of a forest patrol to cover their areas in the shortest possible time, light four-wheeled cars, that travel on the tracks of railroads, have been built.

Railroad Bicycle to Enable Members of Forest Patrols to Travel Speedily through Their Areas

The machines are propelled by pedals and the rider sits on a frame resembling that of a bicycle. Space for carrying tools and other equipment is furnished by a wire basket at the front. In case of fire in the woods, the guard can quickly reach a point on the railroad near the scene of trouble. If necessary an assistant can accompany him on the vehicle.

ELECTRIC SIGNAL TELLS WHEN BATTERY IS FILLED

Storage-battery cells are fitted with the exact amount of water needed, and spilling the electrolyte over the tops is avoided, with a nozzle equipped with a signal light. When the proper level is reached, an electrical contact is formed which lights a lamp. The stream is shut off by releasing a spring trigger that clamps tightly over the

Nozzle Which Has Signal Light that Flashes When Cell Is Full of Water

connecting hose. Thus cells may be filled accurately and quickly in dark places and given the proper amount of water.

Copyright, American Chicle Co.

Automatic Weighing and Boxing Machine that Packs Sugar-Coated Chewing Gum Pellets. During Its Entire Trip through the Factory, Human Hands Do Not Touch the Chicle

Chicle Quest Beats Highway to Tropics

World's Taste for Chewing Gum Once Known to Ancient Aztecs Builds Giant Industry in Few Decades

WITH well over a million dollars a week being spent in America for chewing gum, an enterprise that was launched amid much doubt on the part of the public, not so long ago, has become a leading industry.

It has been only a few decades since it was discovered that the combination of chicle and sugared flavors made a pleasing confection and in that short span of time, its use has become so common that today it is estimated the delicacy claims 75,000,000 devotees in America alone. Abroad, too, the demand for the sweet has caused abundant exportations of the commodity which now is known to almost every people under the sun.

The chewing habit in general is neither new nor limited to any one locality. Every nation and practically every race practices the custom in some form. In India, it has been the betel nut and the lime. Mate leaves afford enjoyment to the people of Paraguay. The Peruvian Indian rests from his labors several times a day to partake of coca leaves with almost as much formality as attends the Englishman's service of tea.

Even chicle, itself, the base of chewing gum, is not a modern find. When the Spanish explorers invaded Mexico, they found Aztec women chewing it quite as universally as their sisters of civilization now do. Mexico is one of the principal sources of chicle, which is gathered in nearly all of the South and Central American countries. The substance is the sap of the sapodilla tree, more commonly known as the sapota, which grows in a wild state throughout the tropics of the western hemisphere. It is a gum resin much like rubber, and is both cultivated and collected in much the same manner. Modern plantations add to the products of the forests, vast tracks of land having been planted with the trees to supply the growing demand.

The sap is collected during the rainy season, when it flows freely. A series of V-shaped incisions is cut spirally in the bark by the native workman, who scrambles up the tree armed with a keen-edged machete. The openings must not be too deep, for though deep cuts produce heavier flows, they also result in the quick death of the plant.

The chicle, resembling rich milk, flows from the incisions into a receptacle at the base of the tree, rapidly thickening and turning yellow under contact with the air.

Native Worker of Tropics Cutting Spiral Grooves in Sapota Tree. Through the Winding Channel Sap Flows to a Receptacle on the Ground to Be Cooked into Chicle

Native women gather it daily and carry it to camp where it is boiled in great kettles or rude vats to rid it of moisture. This cooking process causes the fluid to take on a grayish shade. The chicle is then made up into irregular loaves and is ready for shipment.

This production, at the source, though performed chiefly by cheap and unskilled labor, calls a vast army of workmen and huge sums of capital into service. From Mexico alone approximately $2,000,000 worth of the raw material is exported each year.

The chicle loaf, when it arrives at the American market, weighs about 25 pounds. At its destination, the factory, it is put through various processes of boiling and purification and emerges a silvery gray color. Paraffin wax is occasionally used at this stage as an adulterant, but such methods are not generally practiced. Machinery kneads the cleaned gum with sugar and essential oils that flavor it, rolls it into sheets, cuts it into bars, and wraps them in paper which protects the product until it reaches the hands of the consumer.

Americans are said to spend twice as much for the confection as for pianos and other musical instruments, and England, where the delicacy has only recently been introduced to popular favor, parts with a sum reported to equal $1,000,000 a year for chewing gum. France's people spend annually about $383,000 for it.

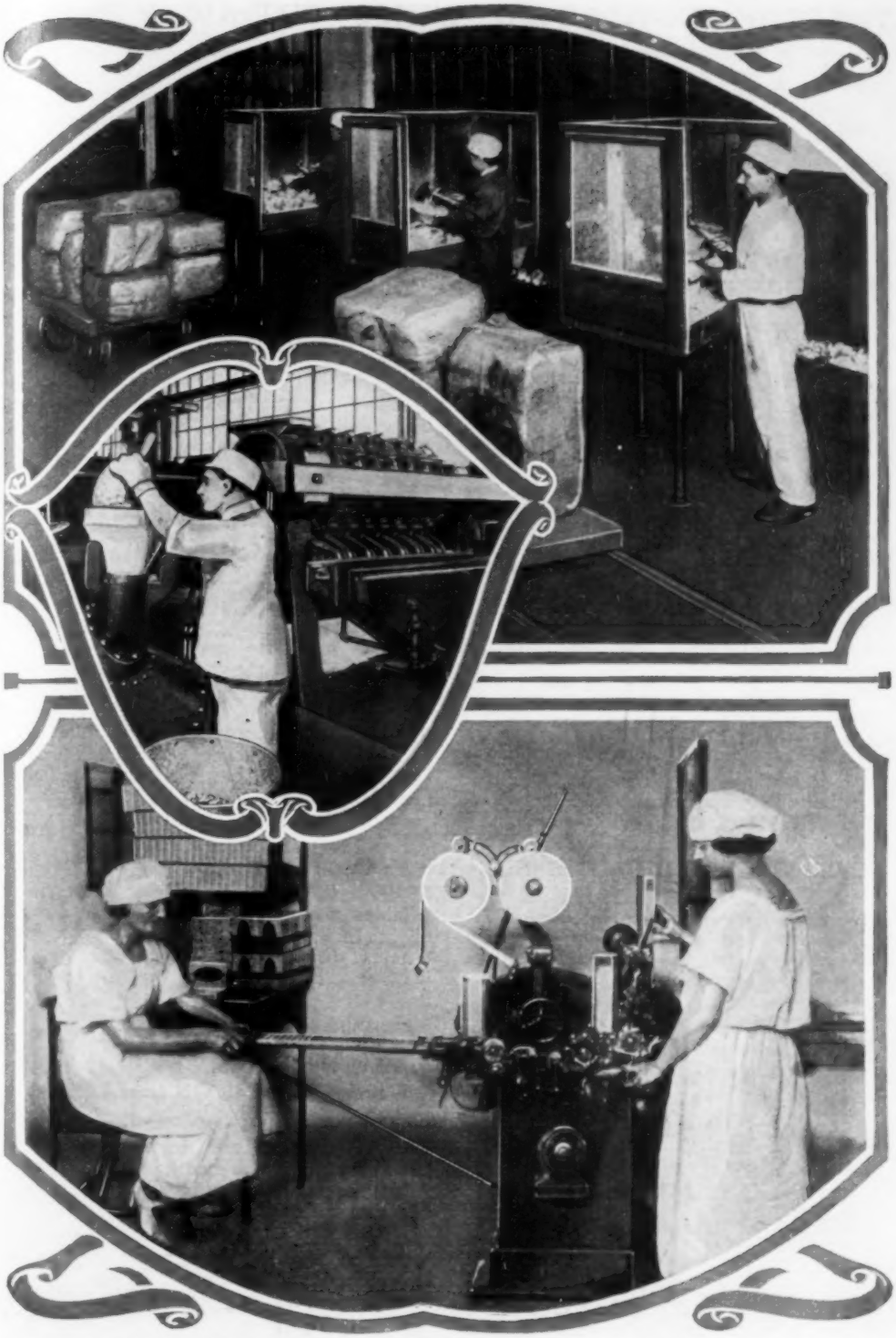
Gum-chewing in the countries of the Allies was given great impetus during the war. British troops who had learned of the refreshing qualities of gum at sports, quickly took to it in the trenches and even as an actual boon when water was scarce.

In France the delightful substance first acquired real popularity when the American troops began to pour into that country. The children were the first ones among the residents of the barrack communities to become acquainted with the sweet. "Chewing gomme, s'il vous plait," —"Chewing gum, please,"—became a familiar request from them to the soldier from the New World. The child invariably gave morsels of the tidbit to grown-ups and the fashion began to spread, even among the peasants.

However, virtually every people who comes in contact with the western tradesmen has to some degree been won to the chewing-gum fad. Recent export figures reveal that the confection is being shipped from the United States to no less than 75 countries and colonies scattered the world over. While the supply sent to Central European states is somewhat smaller than those going elsewhere, the balance is made up by importations of Asiatic nations and Australia on the other side of the globe. Trial exports to the oriental continents amounted to a half million dollars in a single year, and included large shipments to the Philippines, Japan, and India.

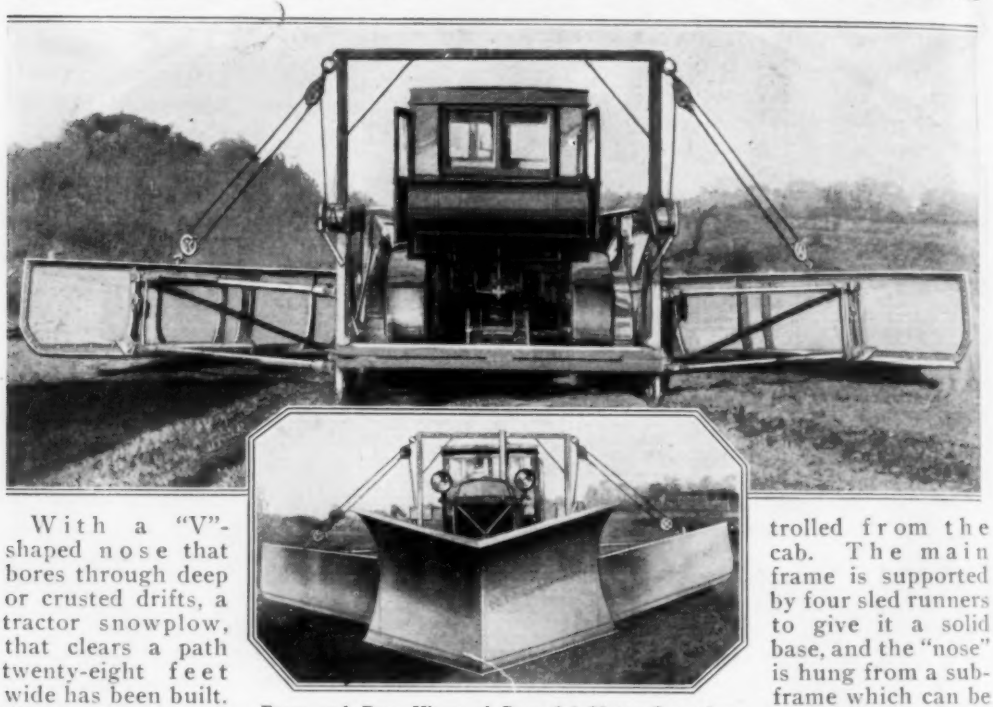
Even South American races have turned to the finished product. The total capital invested in the chewing-gum industries was recently estimated to be $30,000,000, a gain of $20,000,000 since 1914.

Battery of Immense, Revolving Coating Vats which Add a Sweet, Flavored Covering to Tiny Balls of Chicle. After Dipping, They Are Placed on Trays to Cool and Harden



Above, Crumbling Chicle for the Crushers. Center, Putting Powdered Gum in a Steam Drum Connected to a Filter. Below, Automatic Wrapper Covering and Bundling Finished Sticks

TRACTOR SNOWPLOW'S "WINGS" CUT AWAY DRIFTS

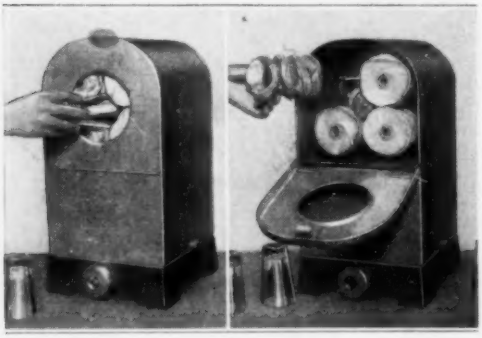


Front and Rear Views of Powerful Motor Snowplow that Clears Wide Path in Drifts

With a "V"-shaped nose that bores through deep or crusted drifts, a tractor snowplow, that clears a path twenty-eight feet wide has been built. The wings, or scrapers, are so adjusted that they can be folded or extended according to the depth of the snow, being raised or lowered by winding drums. The front is adjusted by a hydraulic jack controlled from the cab. The main frame is supported by four sled runners to give it a solid base, and the "nose" is hung from a subframe which can be raised two feet from the surface when the tractor is turned or run over dry ground. The plow is especially adapted to rolling, or irregular country, and is economical in operation.

GLASSES DRIED AND POLISHED BY ELECTRICAL BUFFER

Glass tumblers are dried quickly and given a high polish, free from finger marks or streaks, in an electric buffer that consists of a small cabinet containing five circular pieces of soft cloth that rotate rapidly on spindles run by electricity. The tumbler is inserted so that the center disks fill the inside of the glass. The other four quickly dry and polish the surface. A blast of hot air circulates through the cabinet to keep the cloths dry and to aid in polishing.



Cabinet with Rotating Cloth Buffers Run by Electricity to Shine and Dry Glasses

JAPANESE QUAKE LOSS PLACED AT BILLIONS OF DOLLARS

Interesting statistics regarding the commercial losses suffered in the recent Japanese earthquake are contained in a letter from Yánuma & Co., Ltd., Tokyo, Japan, to this magazine:

"It is aggregated as the most exactitude figure," the letter states, "that the houses broken and burned are 600,000, and the suffering people losing homes are 2,500,000, while 100,000 people lost their lives and 250,000 wounded badly, and the remaining peoples, officials, large commercial organ-

izations and firms are providing their business in the temporary barracks as their homes and damaged buildings or offices:

Chief Buildings and Houses			
80	Official Buildings	280	Factories
180	Police Stations	45	Theaters
12	Embassies	28	Churches
25	Newspapers	350	Office Buildings
24	Clubs	9,125	Big Firms
42	Hospitals	600	Big Hotels
48	Schools	1,500	Big Restaurants
150	Primary Buildings	114	Banks

Firms, Stores, Offices and Houses	
Tokyo	411,000
Yokohama	23,000
Others	116,000
Total	550,000

Damaged, Burned and Ruined in Railway and Tramcars			
30	Buildings	25	Stations
12	Warehouses	21	Locomotives
416	Passenger Cars	893	Freight Cars
1,031	Tram Cars		

Post Office, Telegraph and Telephone Offices Burned or Ruined	
Buildings	40
Poles, cable and burned telephone apparatus	46,000

Burned or Broken Bridges			
Larger	15	Smaller	170

"Total loss for the said damage is informed about five thousand million dollars, while the insured amount is eleven hundred million dollars."

RUBBER HANDLE KEEPS BLADE OF SCREWDRIVER TIGHT

Anchored in a rubber handle, a screwdriver blade has been made, which, it is claimed, cannot turn or work loose. As the tool is completely insulated, it is of special value to electricians. The part embedded in the handle is twisted in such a way as to give it additional strength.

CURB STRIP PROTECTS GRASS

To accommodate persons waiting for cars and to preserve the small lawn between the sidewalk and the street, a Buffalo, N. Y., contractor put a strip of concrete fifteen inches wide inside the curb. The "platform" became popular and served to attract attention to the house, a two-family affair so constructed that the front entrance to the lower flat was from the main street and that to the upper apartment from a side thoroughfare.

"PRAIRIE SCHOONERS" TO RECALL PIONEER DAYS

Recalling the days of the pioneer settlers, a monster parade of "prairie schooners" is being formed from all parts of the

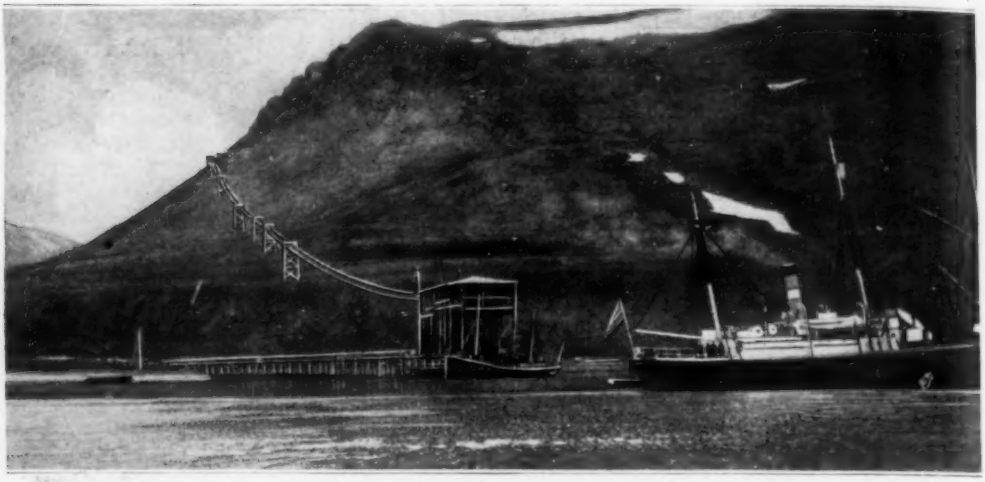
"Prairie Schooner" Ready for Cross-Country Trip to Join Propaganda Parade through Nation's Capital

country by a farmers' organization to spread its propaganda. The covered wagons and teams are to be furnished by those members and sympathizers living at ten-mile intervals from a central point. Signs and legends explaining the cause for which the movement has been created will deck the canvas sides of the old-fashioned vehicles, and the horses will be draped in lettered banners. The occupants will be garbed in the styles popular among the frontier folk of the '50's. It is purposed to have all of the wagons travel to Washington, D. C., and unite for a pageant in the capital.

MEDICINE DROPPER IN BRUSH STOPS WASTE AND STAINS

To apply antiseptics to wounds without staining surrounding tissues or clothing, is the purpose of a combined dropper and brush now on the market. The device is equipped with a cotton wad at the open end through which the lotion is forced. The rubber end at the top of the stem can serve as a stopper, allowing the instrument to remain in the medicine bottle when not in use, and making it a convenience for the home cabinet.

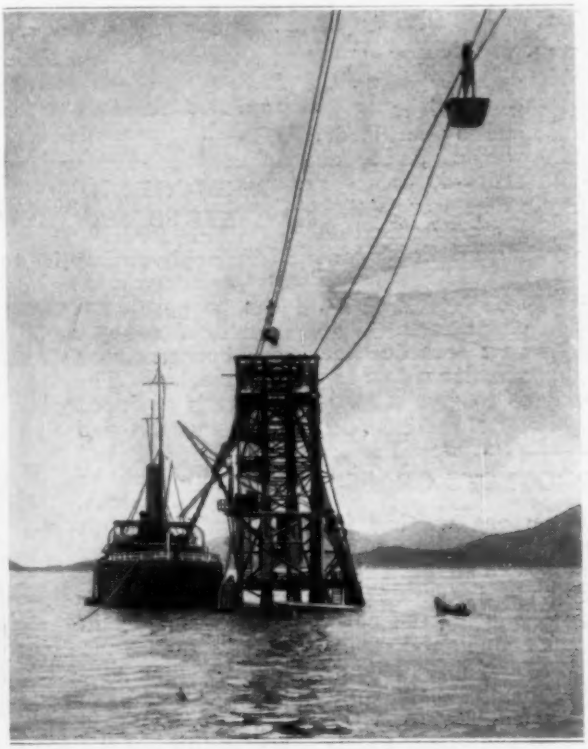
One-third of the silk used in the United States is said to be artificial.



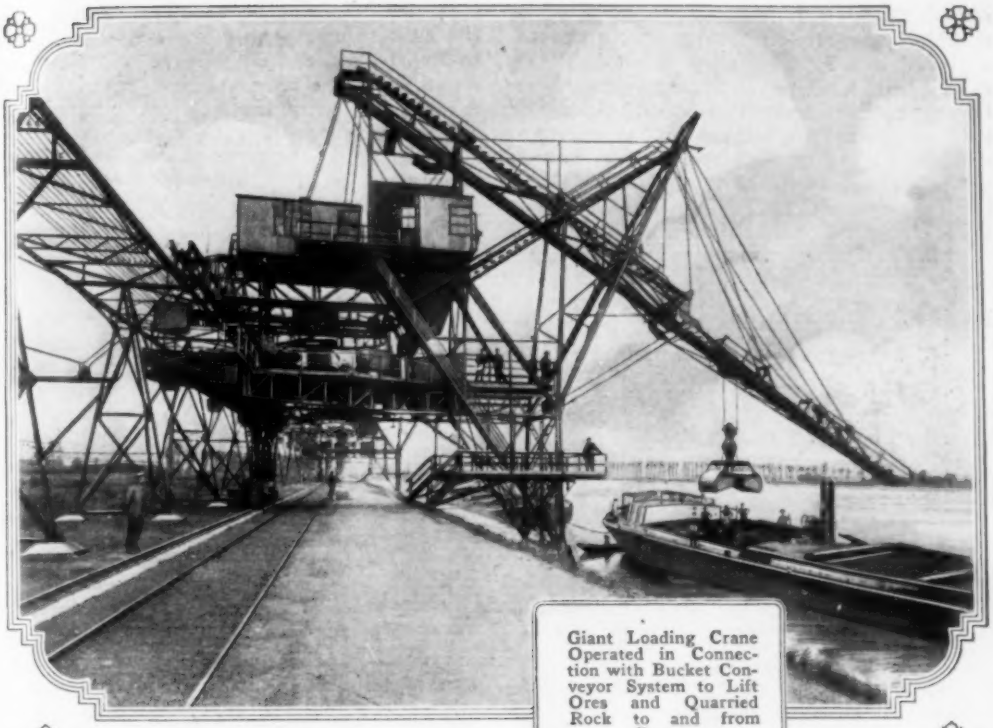
After Traversing Lofty Mountain Ranges and Yawning Ravines this Aerial Cableway Descends to the Quiet Harbor where Its Burdens Are Transferred to Freighters for Overseas Transport

Loading Ships on Difficult Shores

LOADING ships lying off rugged coasts that make their near approach impossible is being accomplished by cable "railways" suspended from hilly heights to bunkers or tipples built on piles far out in the water. Where ore mines are located in the vicinity of the sea, it has been found profitable to carry the material across valleys and ridges by conveyors traveling on overhead tracks of wire rope, instead of shipping to a distant port where facilities are to be found for harboring the boats as well as loading them from wharves. Often vessels are prevented from anchoring close to shore, where their cargoes await, by rough seas that last for days. Some shippers at such points have provided the aerial tramways to convey their products to the holds that are to carry them to markets. At a place on the shores of New Caledonia a loading station has been erected several hundred yards out in the water. Connecting it with the land, is a cable conveyor system which not only serves to place ore cargoes aboard freighters but also carries back shipments of provisions, stores, and even mail for those living in the near inland. Frequently, the rise or fall of the tides seriously interferes with the rapid transfer of freight to and from steamers which have but limited time to



Sturdy Structure that Helps to Defy Rocky Coasts



Giant Loading Crane Operated in Connection with Bucket Conveyor System to Lift Ores and Quarried Rock to and from Barges

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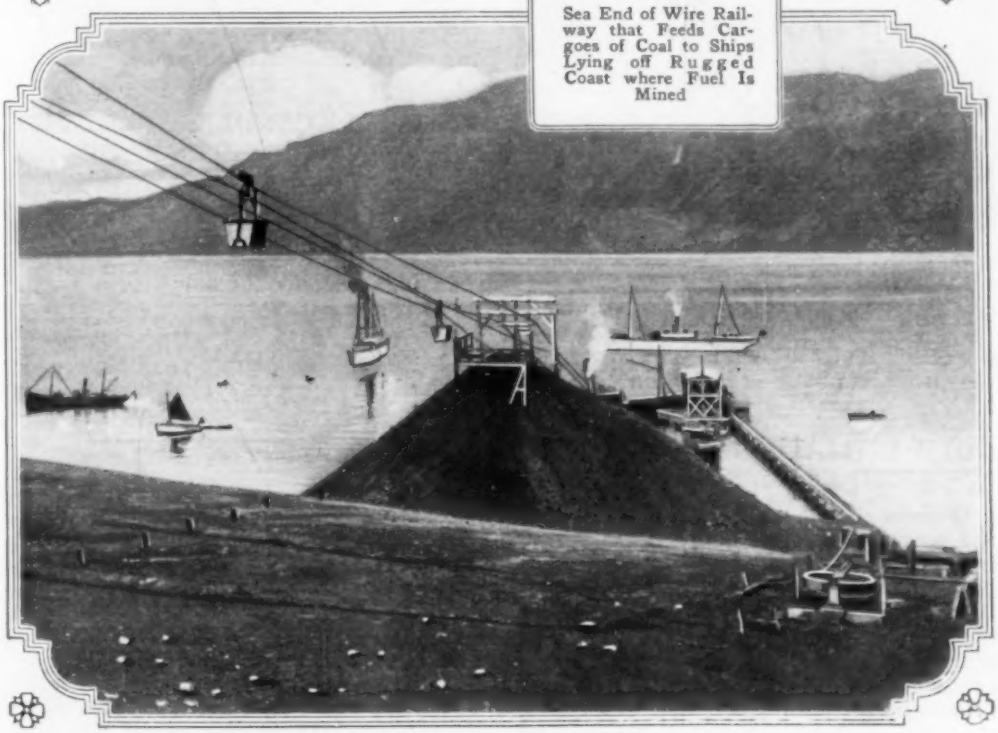
Sea End of Wire Railway that Feeds Cargoes of Coal to Ships Lying off Rugged Coast where Fuel Is Mined



spend at such places. By means of a double-track structure great volumes of material can be handled without the loss of a minute. One such arrangement is known to have transferred more than 500 tons of ore from a bunker on the coast to a ship lying far at sea. Mountains, otherwise difficult to pass, and deep ravines that make overland transportation almost impossible, have been successfully surmounted by stringing wire "pathways" for the swift buckets on wheels, across them to nearby waterways. It is said that in some instances the expense required to carry freight from these points to the nearest seaports would render their cost so high that competition in the market would be useless for the producers. Perishable goods in this way are also quickly transported to their destinations.

INFLATED HUNTING SUIT HELPS IN STALKING WATER GAME

To enable hunters to approach their quarries in deep water without giving alarm, a buoy that can be inflated with air

Copyright, International Film Service

Waterproof Hunting-Suit with Inflated Buoy to Enable Sportsmen to Approach Quarry without Noise

has been attached to the upper part of a waterproof hunting suit. The wearer can paddle about with his feet, and also have a steady rest for his gun. The bag, when blown up, is about 12 inches in diameter.

GOLD STILL FLOWS FROM MINE WORKED FOR SEVENTY YEARS

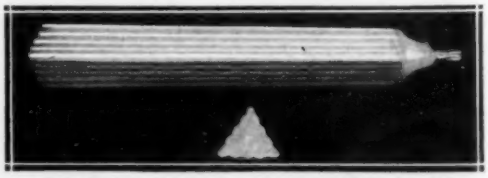
Owners of one of the deepest mines in the world, at Morro Velho, Brazil, have installed a powerful cooling and ventilating system. In the lowest borings, more than a mile below the surface, the thermometer now registers ninety-eight, but the rock temperatures are from thirteen to twenty-two degrees higher. Miners must rest frequently, and two hours of working time are taken daily in getting to the lower levels and coming up again. Although there are immense quantities of ore in sight, enough to keep the stamp mills busy for several years, the great depth of the shaft, and the high cost of operation, may cause a shut down, and if this should occur, the entire district would lose its means of living. The property has been exploited for seventy years, and its annual output is about 2,500,000 dollars.

HARD WOODS IN PAPER-MAKING

Through the discovery of a process by which hard woods can be manufactured into paper, it is believed that some of the forests supplying material for the pulp, can be conserved. Beech, maple, and birch have been found to be available under the new method. Bond, ledger, book and other high-grade papers, are said to be turned out from hard-fibered timbers.

TRIANGLE CANDLE IS GROOVED TO GIVE BETTER LIGHT

Light-giving power of candles has been increased by British chemists who made them in triangular form, according to recent reports. The three sides are grooved the full length of the stem in order to give a free path to air, which, it is believed, flows freely upward to the wick. Owing to their shape, they are said to fit almost any holder. Where the socket is small, the corners of the candle can be easily shaved



Triangular-Shaped Candle with Grooves to Increase Light-Giving Powers and Eliminate Waste

off and the end pressed into the opening. The three flat sides result in a saving in space when packing.

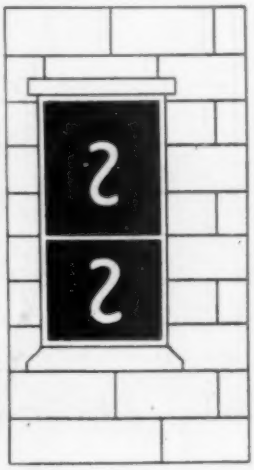
"ELECTRIC MAN" CLIMBS STAIRS TO SHOW WAY TO STORE

To attract prospective customers to his store on the second floor of a building, a merchant in Buffalo, N. Y., shows the way by a moving electric sign that depicts a man climbing stairs leading into a front window of his establishment. Each trip taken by the incandescent "patron" consists of six steps, and with every upward movement the figure grows smaller, until it seems to disappear through the opening. When the journey is completed, the power is flashed off for a few seconds, after which the action is repeated.

RANGE OF ALUMINUM VIOLIN INCLUDES TONES OF 'CELLO

Made of aluminum, a violin, said to include the tones of the 'cello in its range, has been tested. Somewhat crude in appearance, it differs in shape from the ordinary type. Every part of the instrument, including the strings, was constructed by the inventor, laboring alone. Only one small piece of wood was used. There are no "f" holes, as perforations take their place. The sounds evoked are resonant, octaves may be played without stretching the hand, melody and accompaniment are simultaneous, and three sustained tones may be held.

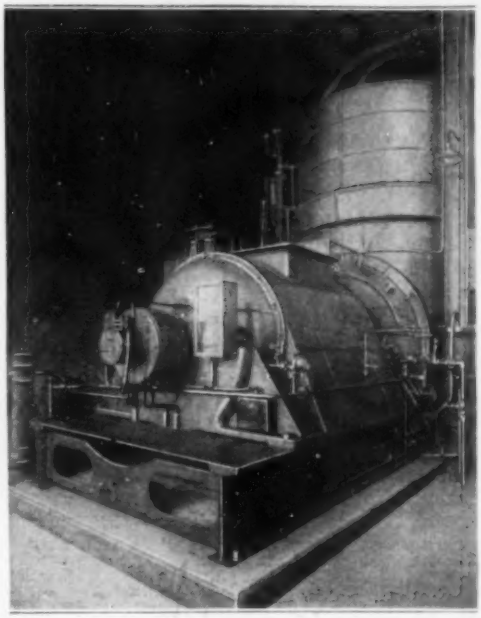
INITIALS ON WINDOWS SAVE GLASS AND LOOK TIDY



Neat initials painted on the panes of skyscrapers under construction in Chicago recently gave the buildings a tidy appearance while they were being finished, and helped to advertise them as well as warn workmen that the glass was in. The plan attracted wide attention and proved a pleasing contrast to the usual smears that are placed on the windows. The sharply outlined letters were visible for blocks and rows of them, the height of the structures, made the buildings conspicuous.

MERCURY BOILER TESTS SHOW BIG INCREASE IN POWER

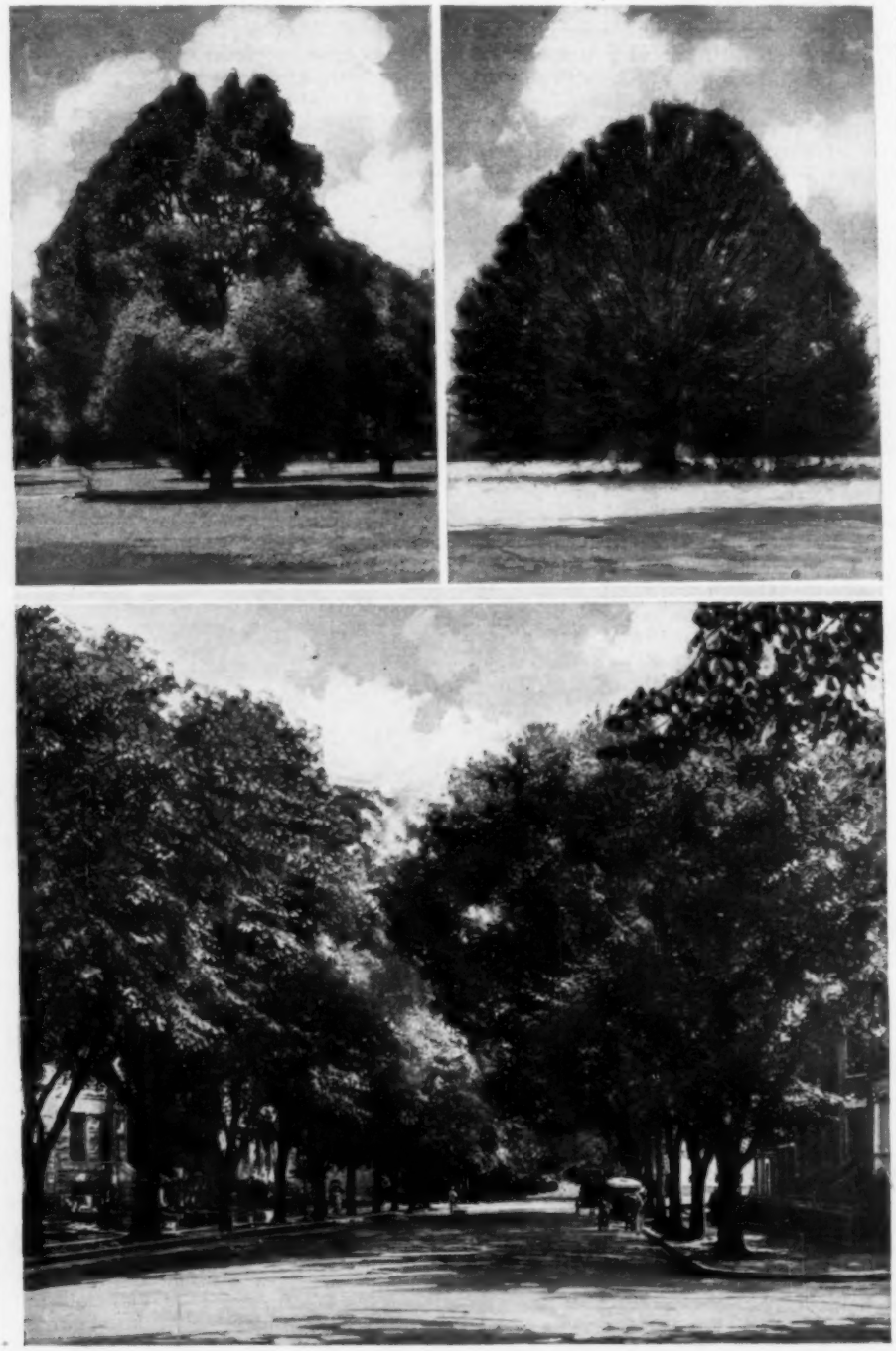
Power from a plant in which turbines for generating electricity are driven both by mercury and water vapor from the same



Mercury-Vapor Engine that Showed Great Increase in Efficiency in Recent Tests

fuel source, resulting in a gain of about fifty per cent in power to a pound of fuel, is declared to be the outstanding achievement of a new boiler recently tested. During the experiments it was found that no form of packing or corking of the joints would resist the mercury vapor. It is said that the development of arc and acetylene welding has made such apparatus possible. The process involves the vaporization of mercury in a boiler, driving of a turbine by the vapor and the condensation of the exhaust in a cooler where its latent heat is delivered to water, and thus used to generate steam at pressure suitable for use in existing engines. The condensed mercury runs back by gravity into the boiler. The result is that the temperature range is more than doubled, and the efficiency consequently greatly increased. The mercury boils much like water, except that its density is much greater and its boiling temperature much higher.

¶In an emergency, when the auto-jack handle has been forgotten, the crank handle can usually be used instead.



Camphor Tree (Above, at Right) which Will Endure More Frost than the Orange; a Darlington Oak (at Left), and, Below, the Elm, a General Favorite for Street Planting

What Trees Are Best for Town and City?

Government Experts Find that the Sturdy Oak Is Generally Better Suited than the Maple for Street Planting

By ROBERT L. MOULTON

WHICH trees will do best in town and city streets?

If we may judge by the frequency with which the maple is found in most parts of the country, this tree is generally regarded as best adapted to street planting. Yet, according to the department of agriculture in a recent bulletin, oaks are really more desirable.

It is probable that more oaks have not been grown because of the belief that they are slow, and because in the North they are rather difficult to transplant. A white oak, however, which is one of the slow-growing varieties, will reach the same height as a sugar maple in the same period of time, and maples have been used much more widely than oaks for street ornamentation, despite many unsatisfactory characteristics.

This conclusion has been reached after a long period of experimentation conducted by government experts with a variety of trees in different localities. Elms are given second place in desirability for city streets, and sycamores third. Except the Lombardy species, most varieties of poplars are not recommended.

Before ornamental tree-planting is undertaken, a number of important points must be given attention. Trees native to one part of the United States may not thrive in another. Some are objectionable because their roots penetrate defective sewers, while others grow their roots so near the surface that they have a tendency to heave or crack sidewalks.

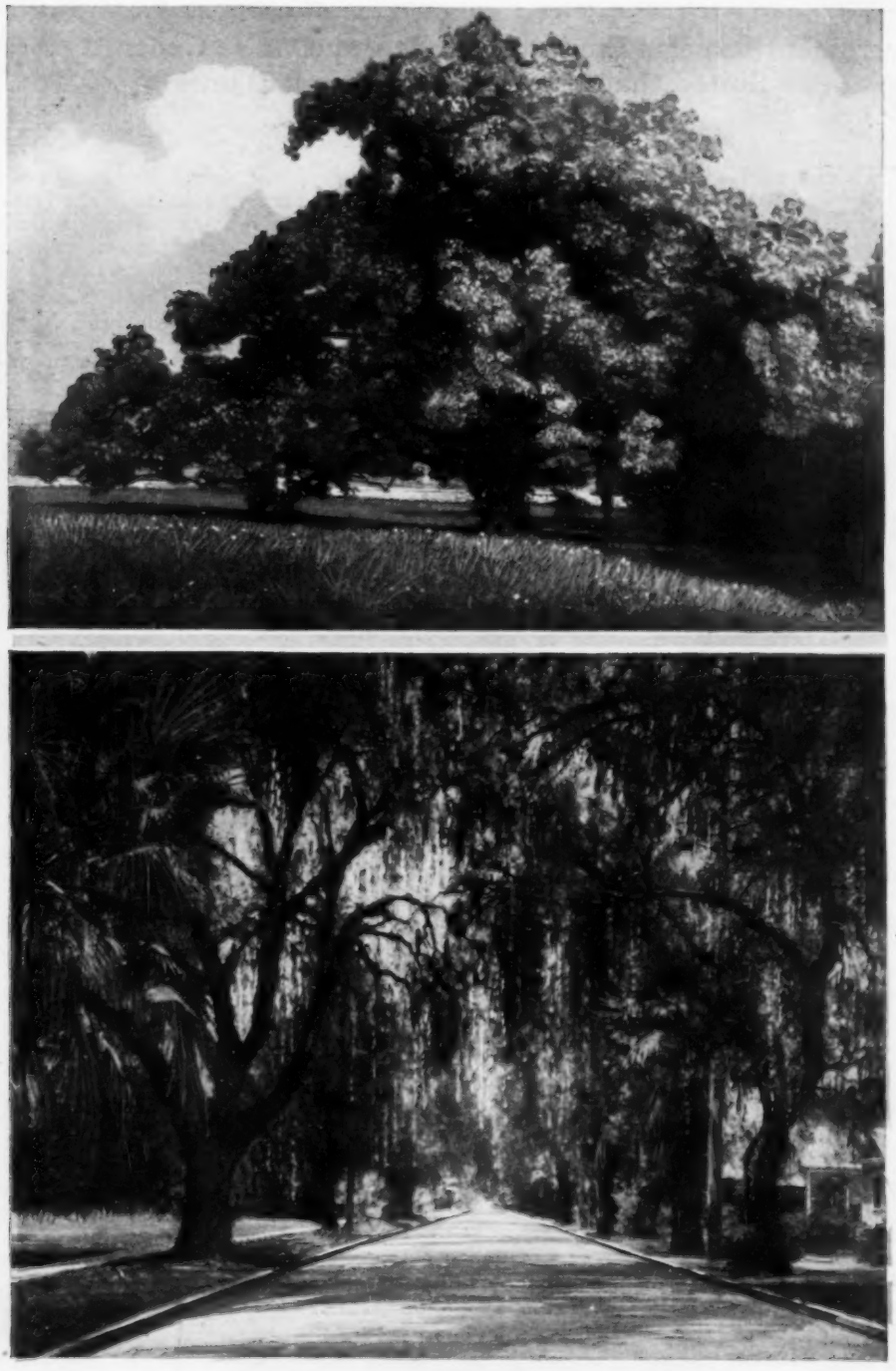
Only vigorous trees that will withstand the dust and smoke of a city should be planted to ornament the streets. The root system should be hardy, not easily affected by unusual soil conditions, by restricted feeding areas, or by root pruning, in case improvements are made. The shape of the top of the tree should be suited to the width of the street. It should be rather high headed, or easily trained to that form, and of open growth.

Of only a little less importance is the character of the foliage masses, whether dark or light, heavy and somber, or open and airy, and also whether the foliage has vivid autumn colorings. The resistance of the tree to fungi, insect pests, and tree diseases, is another important consideration. Varieties that bear showy flowers, fruits, or nuts are usually undesirable for street planting. Palms do not make good shade trees, although they are effective in formal planting. Only in the most southern parts of the country, and in western California, should evergreen trees be used. Magnolias, live oaks, and a few other broad-leaved evergreens, may be planted in these regions. Where there is lack of sunshine in winter, due to short or cloudy days, it is desirable to admit all the light possible by using only deciduous varieties.

In all sections, trees differ greatly in the time when they put out their leaves in the spring and lose them in the fall. Narrow streets should be planted with tall, slender trees like the Lombardy poplar, or in some cases with small trees. Broad streets may be planted with spreading trees; or, if provided with a central-parking space, with moderate-sized trees in the center and on the sides, or with trees on the sides suited to the space, and formal trees in the center. As a rule, native trees that have been tried out successfully in other towns should be given the preference.

Street and Sidewalk Cracked by Shallow, Spreading Roots of the Popular Silver Maple

For use within reach of ocean spray, or on sandy lands near the coast, the red oak, and the red or scarlet maple, are suitable as far south as Charleston, S. C., while the



Because of Its Thick Foliage, the Oak (at Top) Is Known as One of the Best Varieties for Street Planting; a Row of California Pepper Trees Are Shown Below

Honey Locust Trees Fringing City Street

sweet gum and the live oak are equally good from Norfolk southward and along the Gulf of Mexico. The red oak, sweet gum, red maple, and eastern live oak are all grown successfully along the Pacific Ocean, while the California live oak can be used from San Francisco southward.

In the heart of a city, where the greatest difficulty is experienced in getting trees to grow, the Ailanthus, or tree of heaven, will probably thrive when nearly all other kinds fail. The staminate and pistillate flowers of this species are borne on separate trees. Only the pistillate trees should be used, as the odor of the blossoms of the staminate trees is very objectionable for about ten days in late spring. These may be produced by grafting, or by propagating from suckers, or root cuttings, from such trees if they have not been grafted.

The American elm, sometimes called the white or water elm, is one of the handsomest of shade trees. It has been the standard tree of New England, giving to the roadsides and village streets the characteristic appearance which is so attractive to summer visitors. It is tall and spreading, and where planted as near together as is customary on streets and roads, the effect is that of an arch formed by the growing together of their spreading tops. It is of rapid growth, long lived and comes into leaf early in the spring. Because of the attacks of the leaf beetle and the European bark louse, many handsome trees have been severely damaged or killed before communities were properly equipped for fighting them, but with careful spraying these insects may be kept in check. On account of the existence of the pests, and because they are gradually spreading to new territory, tree planters should consider carefully whether it is advisable to plant the elm.

All of the oaks are hardy, most of them long lived, and generally they are free from disease and insect attacks. The red oak is probably the best for street planting in most sections of the United States. It is a large, oval, open-headed tree of rapid growth. Under good conditions, it will grow four feet in a single season. Like the other oaks, it is slow in coming into leaf in the spring, but holds its foliage late in the fall. The leaves usually turn a brilliant red before they drop. The live oak, a noble and majestic tree, is adapted only to the extreme southern states. As its name indicates, it is an evergreen, and is of slow growth, but, wherever it is found, it is the pride of the people.

Although not as satisfactory as usually has been supposed, the red maple is one of the most widely distributed American trees. It is found from Canada to the Gulf of Mexico, and west to the Rocky Moun-

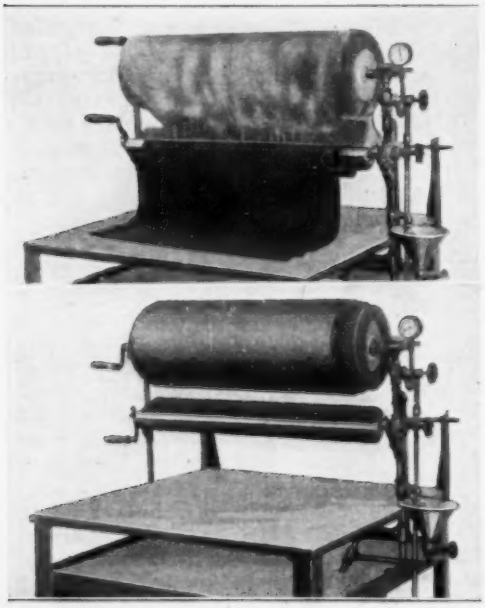
tains. Its leaves are the smallest of the eastern native maples, but it grows large and is usually of upright outline. It is better adapted to suburban conditions than to city streets, and is one of the few trees that succeed well near the ocean. It has bright-red blossoms before the leaves appear, and the young leaves and fruits are also red. The mature leaves begin to color early, some branches as early as the middle of July, assuming brilliant reds and yellows and staying on longer than those of the sugar maple. This handsome tree is not as much used as it deserves to be.

The silver maple is probably more used for street planting through the whole United States than any other tree, although it is one of the least desirable. It is usually planted bcause it is quick growing, but it is not more rapid in growth than several other trees, that are much better.

There are three serious objections to its use as a street tree. The first is its brittle wood, which at an early age is easily broken by ordinary windstorms. The second is its shallow rooting, which has a tendency to destroy pavements, and also makes it difficult to grow grass near by. The third is its tendency to decay; the tips of the limbs frequently die, leaving the whole top of the tree bare of leaves, and the wood decays quickly, especially if the bark is broken. For this reason it does not stand pruning as well as other street trees, and it probably has been pruned more ruthlessly than any other, unless it is the Carolina poplar. It should never be severely deheaded, or, as it is popularly called, "dehorned," as the stubs will practically never heal over, and from these cuts decay will start, which, in a very few years, will rot the center of the limbs and trunks.

CLOTH IS SHRUNK AND SPONGED BY STEAM ON ROLLER

Cloth for suits is quickly shrunk and sponged on a machine built especially for small tailoring shops. Steam generated from a gas-heated boiler passes into a perforated revolving drum on which the goods



Sponger that Forces Steam through Fabrics to Shrink Them for Tailoring into Suits

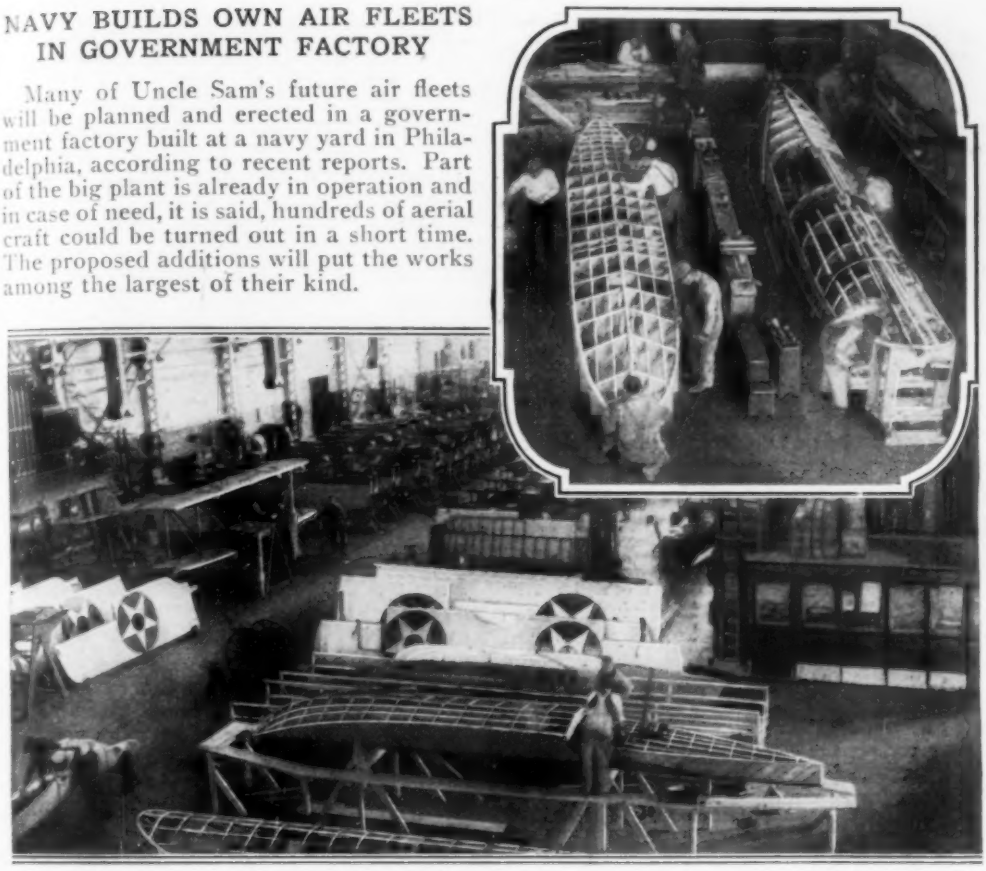
are wound from a reel below. Pressure forces the vapor through the threads of the fabric in any quantity desired, a release valve at the side affording constant control. A brass roller on the drum presses the cloth, guides, and straightens it. The apparatus is safe, simple, easy to operate and costs little to install. The base forms a convenient table on which the bolts of goods are laid and is used as a work bench when the sponger is not needed.

BELL AND BUZZER BATTERIES REPLACED BY TRANSFORMER

Designed for reducing direct current to low voltage for the operation of electric signals, clock systems, burglar and sprinkler alarms, bells, buzzers and many other devices commonly run by batteries or motor generators, a transformer of simple construction has proved effective. It contains no rotating or vibrating parts, is economical, current being drawn only when contacts are made. It is also equipped with signal lamps that indicate irregularities on any circuit. It is safe, simple to install and carries no maintenance expense, being automatic in operation.

NAVY BUILDS OWN AIR FLEETS IN GOVERNMENT FACTORY

Many of Uncle Sam's future air fleets will be planned and erected in a government factory built at a navy yard in Philadelphia, according to recent reports. Part of the big plant is already in operation and in case of need, it is said, hundreds of aerial craft could be turned out in a short time. The proposed additions will put the works among the largest of their kind.



Assembling Planes on Erecting Floor of Navy's Aircraft Plant that Will Be Among World's Largest Airship Factories. Above, Getting Body Frames Ready for Covering

RECORDS PROVE WEATHER MEN NEARLY ALWAYS RIGHT

Winter means hardship, not only to those exposed to it, but to the scientists responsible for forecasting the weather for the United States, as they are rated and graded like pupils in a school. Their every prediction is compared with the actual ensuing conditions, and when they are wrong, down goes a black mark for them. With the coming of cold and snow, the difficulty of keeping a high average of accuracy is increased for two reasons: There are more storms to keep track of, and they move across the country twice as fast as in summer. With a velocity of from 600 to 900 miles a day, compared with 300 to 400 miles during the warm months, these disturbances from the Arctic regions sweep down from the northern border, almost without warning. Only when they are signaled by Canadian stations at Medicine Hat and Prince Albert does the weather bureau know they are coming. When the forecasters step up before the charts on which the conditions prevailing in their districts are marked, they stake their reputations that they can accurately predict the kind of weather that will occur over several states within twenty-four hours. For instance, if the weather man says "rain," the records for the day for which he is predicting must show precipitation of at least 1/100th of an inch. If he says "probable showers" and winds do not occur, his prediction is counted a failure. But, despite these handicaps, the records show that the weather men have been right eighty-eight per cent of the time in their predictions.

¶Approximately 6,000 new species of insects are found and classified each year by scientists.

Photo Press Rivals Speed of Printing

Machine Automatically Develops, Prints, and Dries 30,000 Pictures, Taken by a Camera, in an Eight-Hour Day

By A. N. MIRZAOFF

EQUALING the speed of high-powered printing presses, a photograph machine used by a Chicago concern, finishes nearly 4,000 copies of its product in an hour.

Instead of a type form this device begins its process with the negative, passes the paper stock through a developing bath, exposes the film over it, and fixes the print, before carrying the sheet on to the drying machine where the strip is wound on a roll.

The operations are not confined entirely to pictures. Letterheads, sales letters, bill forms, and ornately decorated stationery are rapidly turned out complete with genuine photographic finish rivaling that of the most up-to-date studio. It is claimed that in accomplishing the work in this manner, a task usually requiring the attention of fifteen men is done by less than half a dozen people.

From the time the first end of the sensitized roll of paper is inserted into the machine until it emerges from the drying compartment, there is no stop in its development. Any number of subjects can be placed on one negative and if lettered matter is desired, this, too, can appear in any position in company with illustrations.

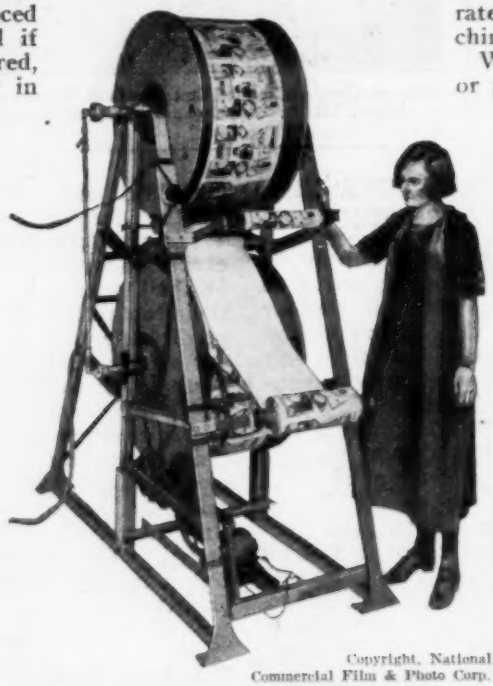
Exposure is made by a "lamp house" through which the paper must pass. Strong lights are here adjusted to give any amount of necessary illumination to the negative. The length of the exposure is controlled by a regulator that times the duration which ordinarily occupies from one-tenth of a second to two seconds, according to the requirements. As each exposure ends, a shifting device pulls the paper a limited distance through the machine to make way for the next operation.

Development is automatically governed by a bar which raises and lowers the paper as it passes over a roller in the bath. An acid rinse follows, which arrests the developing process so that a uniform finish will appear on all pieces of a lot.

In order to "fix" the print, it is subjected to a hypo solution, and is sprayed with water from six strong jets to insure a thorough washing. Before it is drenched again, the sheet goes through a hardening fluid where the film with which it is covered is made hard and tough to resist wear that results from handling. Powerful wringers then squeeze all surplus water from the stock in order to make the task of the drier an easy one. Two gas-heated drums evaporate the remaining moisture as the strip is carried over them and hot silver-plated rollers at the same time ferrotype the product and give a high-gloss finish to the surface. The dry rolls are finally slit into lengths of four feet and the different photo-prints are separated by a cutting machine.

Where an entire letter or page is to be printed by the photograph press, the matter is first set up in type and a perfect proof of it is exposed before the camera. From the negative an unlimited number of copies can be made. The sensitized paper stock is delivered in rolls of a thousand feet in length.

The eyes of the watchful attendants are always on the delicate apparatus and sign of any irregularity in the machine's motion is sufficient cause for halting it for investigation. All work in the room is done under yellow light.



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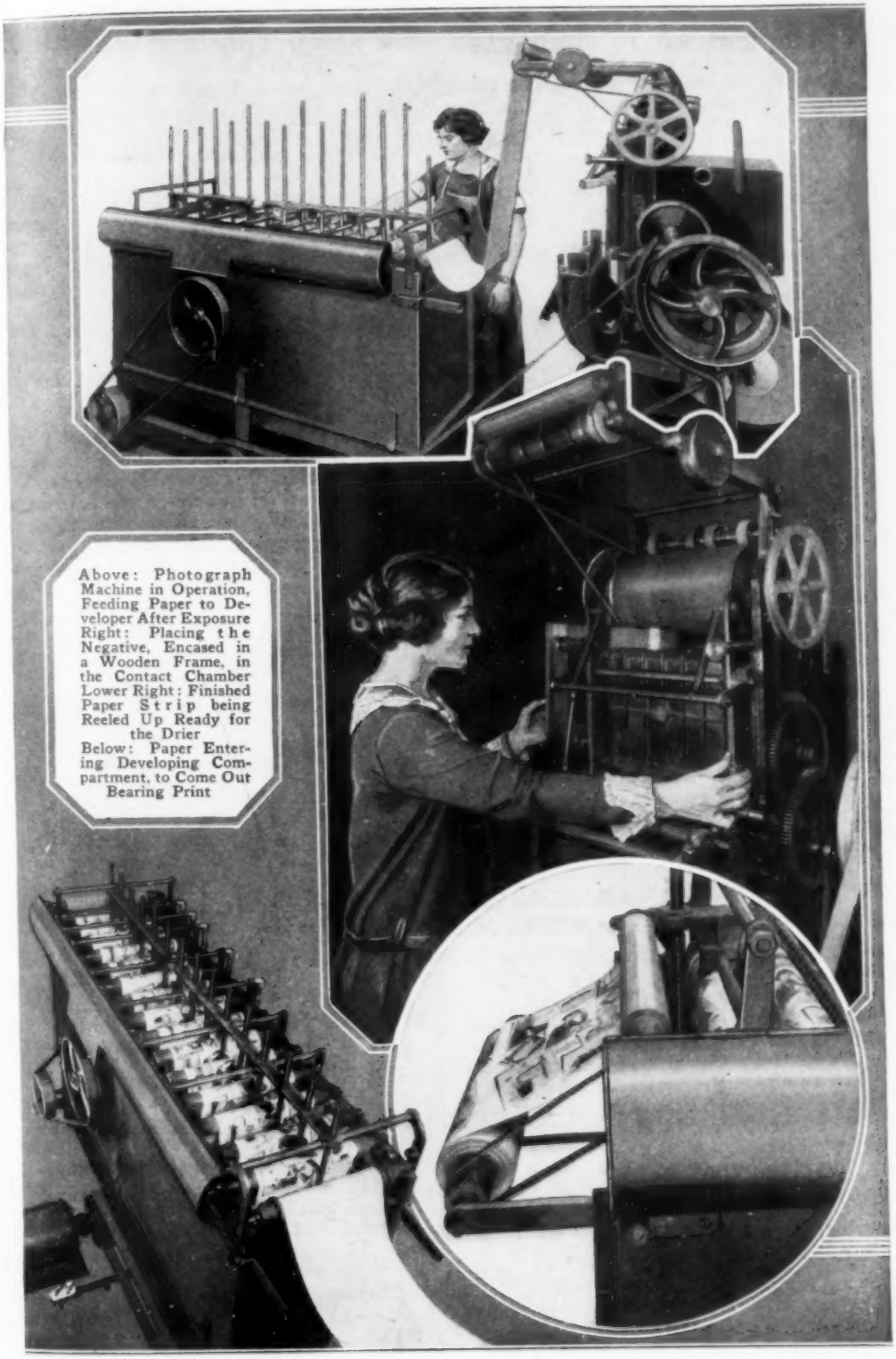
Gas-Heated Drying Drums where Moisture Is Removed from the Paper Ribbon which Is then Wound in Rolls



Above: Photograph Machine in Operation, Feeding Paper to Developer After Exposure
Right: Placing the Negative, Encased in a Wooden Frame, in the Contact Chamber
Lower Right: Finished Paper Strip being Reeled Up Ready for the Drier
Below: Paper Entering Developing Compartment, to Come Out Bearing Print

Copyright, National Commercial Film & Photo Corp.

MOVIE CAMERA HOLDER MAKES USE OF A TRIPOD NEEDLESS

So that motion pictures may be taken without the need of supporting the camera on a tripod, a frame holder that fits

Holder for Movie Camera that Permits Its Operation Without the Need for the Usual Tripod

about the shoulders, has been invented by a Dutch airplane expert. It is expected that this will be particularly serviceable in taking views from planes and in positions where it is impossible to use the ordinary tripod. Because of the speed at which the exposures are made, a solid rest, which also will leave the operator's hand free to turn the crank, is a necessity for the camera.

POISON FOR COYOTES REPLACES TRAPS AND SAVES CATTLE

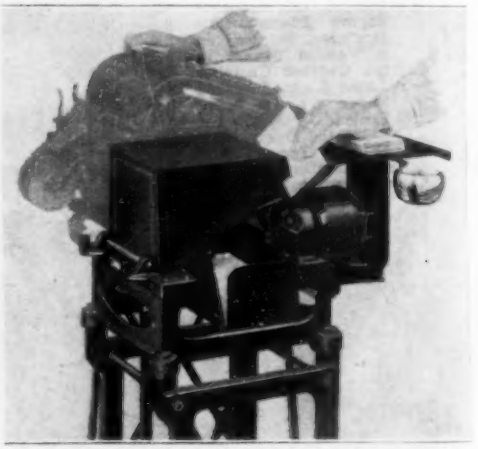
More than 75,000 coyotes were killed by poison last year, according to recent government estimates. In the past few years this method has been replacing trapping in many localities in the west. One man in the Lemhi national forest in Idaho, by use of an automobile, maintained a poison line 700 miles in length. The result is said to have been a great saving to stock raisers, especially sheep men.

"TOWN-LOT" DRILLING FOR OIL CAUSE OF GREAT WASTE

Unusually close spacing of oil wells, or what is known as "town-lot" drilling, has been responsible for great waste in many petroleum fields in the United States, according to a report by the department of the interior. This form of development has become a factor in southern California. In the Santa Fe Springs project, wells are being drilled on adjacent town lots, some of which are not more than 120 feet apart. Because of the great depth and high cost, it is predicted that many of these wells will not pay for themselves. Although oil can be recovered more rapidly and in larger amounts with a great number of wells, if they are drilled before the gas pressure is reduced, too rapid exhaustion of oil and gas may cause the rapid approach of edge water, pocketing large quantities of oil.

CHECK ENDORSER SAVES TIME IN BANKS AND OFFICES

To save time in preparing large numbers of checks for clearing houses, an automatic machine for endorsing them as they are listed has been invented for banks and other financial offices. It is designed to stand near the lister and as checks are inserted, it prints in clean-cut, legible letters from metal dies, the bank's endorsement,



Endorsing Machine and Lister in Background Used as a Unit in Handling Checks

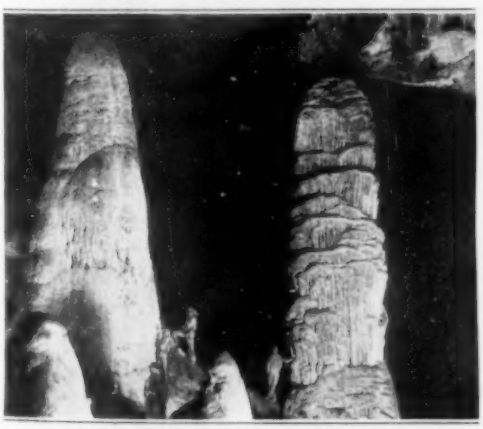
and stacks them right side up in the same order that they were in the original pile. As checks are listed before they are sent out, with this device, the two operations, listing and endorsing, are done practically at the same time, thus saving extra handling. It is easily cleaned, is noiseless, runs by a small motor and requires little attention. If checks are dropped in on a "slant" they are automatically straightened before the impression is made. The metal dies, fed from a regulated ink well, print more legibly than rubber stamps and are easily changed.

AUTO CASTINGS MADE OF "DUST" FROM BLAST FURNACE

"Dust" from a blast furnace at one of the large automobile manufacturing plants in the middle west has been found to contain nearly fifty per cent iron ore, and is now being reclaimed for the manufacture of cylinder castings. Sufficient material for making 600,000 of the parts, each weighing eighty-two pounds, is in one of the heaps that have collected outside the furnace. A special plant where the substance is to be mixed with iron borings and fused into chunks of proper size and weight to be handled in the molds is being erected. Gas flames are passed over the dust and the process is aided by a large percentage of coke collected from the blast furnace.

GREAT BAT CAVE IS MADE PART OF NATIONAL PARK SYSTEM

By a proclamation of the president, Carlsbad Cavern, an immense cave in New Mexico, has become part of the national park system. Although not yet thoroughly explored, the cavity is known to consist of many great chambers that harbor thousands of bats. The ceilings are so high at some points that rays from torches fail to penetrate to their arched recesses. The total length of its hallways and rooms is more than three miles, and the floor is almost 200 feet below the entrance, while it is believed that the deepest parts may lie 1,000 feet lower than the rugged doorway. Experts say that the soft limestones, from which the opening has been carved, may reveal spectacular conditions equaling any other like formation now known.



Gigantic Stalagmites that Rise, Sentinellike, from the Dark Depths of Carlsbad Bat Cavern

MOTORCYCLE IN JUMP COVERS EIGHTY-FOUR FEET IN AIR

After speeding down a steep incline, a motorcyclist at Boise City shot through the air for a distance of eighty-four feet, during an exhibition to illustrate the strength of his machine. A height of nine and one-half feet was attained at the summit of the arc described by the soaring motor and its rider. The fall was broken by a specially prepared landing ground, and little injury was done to the man or motorcycle by the "flight." The movement was so rapid that distortion was apparent in the photograph although a rapid lens was used. Skill and daring were required to hold the machine on a straight course and insure a good "take-off," in order to prevent a disastrous "spill."

Motorcycle and Daring Rider Hurtling Eighty-Four Feet through Air in Exhibition Jump

MOUNTAIN STREAM RUNS PUMPS FOR TOWN'S WATER SUPPLY

Dropping a distance of 180 feet, a mountain stream used as part of the water supply of Redlands, Calif., operates a turbine connected to a deep-well pump. As the water is raised to the surface, it joins the flow of the stream, and the combined volume is discharged into a tube leading to another pump. Here the same process is carried out, the three streams finally being united and passing into the reservoirs that supply the town with water.

Pineapple Plantation Covered with the Strips of Mulch Paper; Insert, Laying Paper, Showing How Earth Is Turned Over Edges to Keep the Wind from Blowing It Away

Papering the World to Make Crops Grow

STRIPS of paper, three feet wide and less than one thirty-second of an inch in thickness, have increased the production of pineapples in the Hawaiian Islands by more than forty per cent. Laid in a field of sun-grown Sumatra tobacco, in Florida, the same kind of paper increased production more than fifty per cent. Papering fields of tomatoes in California raised their yield by some sixty per cent, while strawberries, their roots so protected, produced forty per cent more berries than the same varieties planted in a neighboring and unpapered field.

For fifteen months or more, prior to 1923, experiments in the papering of pineapple fields in Hawaii were carried on with uniformly the same results. This year, more than 4,250 miles of paper were laid, at a cost of approximately $250,000, on the pineapple plantations of Hawaii. The result is an increase of from twenty-five to sixty per cent in the production of the pineapple plants, an average of at least forty per cent; the elimination of weeding, which costs on the average $45 per acre; the conservation of moisture; the prevention of baking of the soil, and the removal of the necessity for cultivation throughout the crop life of the pineapple, which is about five years.

The device is the discovery of C. F. Eckart, the Burbank of the Hawaiian Islands. It consists of the laying of a mulch paper, made of asphalt-treated felt, not dissimilar to a thin roofing paper, in rows across the field. In this paper, six inches from each edge, and, therefore, twenty-four inches apart in the center, holes are punched with a trowel, and the pineapple cuttings, "ratoons," are set in these holes. As the paper is laid, the earth is turned up over the edges, to hold it flat and to prevent it from blowing away. The plants are set "staggering" in adjacent lines, so that while the rows along the paper are even, those across the field are not.

Pineapples Growing through Paper: Above, Laying Paper with Tractor

The same method used in the planting of the pineapples is adopted in the setting out of tobacco, tomato, cabbage or other plants. Experiments are now being conducted on the use of the paper with grapes, and with flowering plants, in short, with

all crops which have a high value per acre. It also has been applied with success to sugar cane in the Hawaiian Islands. Not only does it increase the amount of production of each plant, but it increases the size of the fruits or vegetables or the number and size of the leaves.

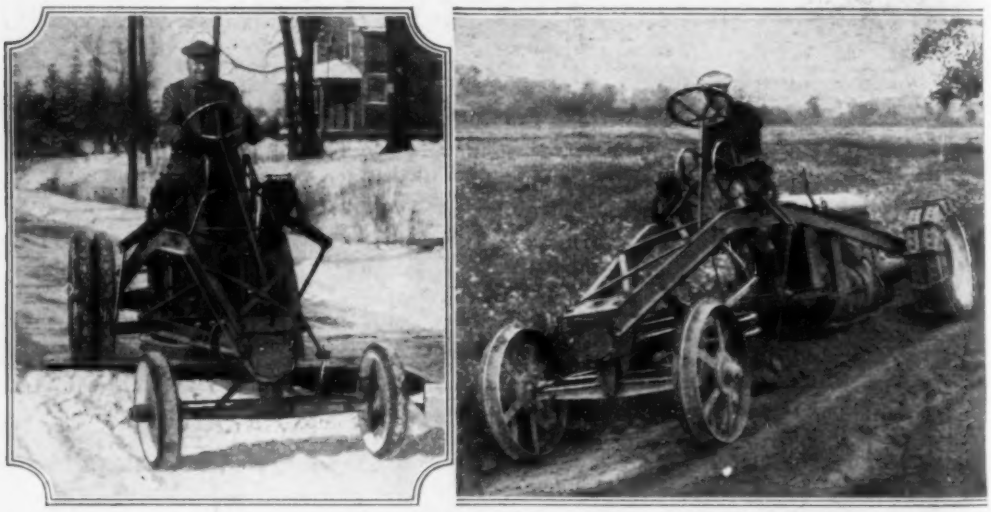
The paper virtually puts every plant root into a forcing hothouse. The roots are kept shaded, heat is retained as is also moisture, the combination necessary to the greatest root and plant growth, and weeds, being unable to pierce the paper covering, cannot grow. The use of the paper, by this combination of retained heat and moisture, has extended the area in which pineapples can be produced profitably to higher altitudes and colder temperatures in the Hawaiian Islands than ever before. In Florida, the increase in individual fields of sun-grown tobacco has reached as high as seventy-one per cent, but this is above the average. In the culture of tomatoes, the increase in yield ranged from twenty-one per cent to 168 per cent, under widely varying conditions.

Surface evaporation from the area covered with the paper is so greatly reduced that it is virtually negligible, the moisture being conserved entirely for the use of the plant. This reduction of surface evaporation to a minimum eliminates the undesirable and often disastrous caking and cracking of the soil. Heat loss by evaporation of surface moisture also is prevented, producing and maintaining additional warmth in the soil. The paper receives the direct impact of the raindrops and so prevents the soil from packing. Some of the papers used are perforated with many small holes, so as to allow moisture from rain, dew, and fogs to seep slowly through, increasing the moisture so stored in the soil beneath the paper.

The paper is applied by hand, with men carrying the rolls on steel rods, and other men following behind with hoes to cover the edges with a binder of earth; by machine layers, drawn by horses, with special devices for the turning in of the binder of earth; and, on level fields, by double machines, laying two rows at a time, drawn by a tractor. These machines also lay their own earth binder.

ONE-MAN ROAD GRADER DIGS DITCH, PLOWS SNOW

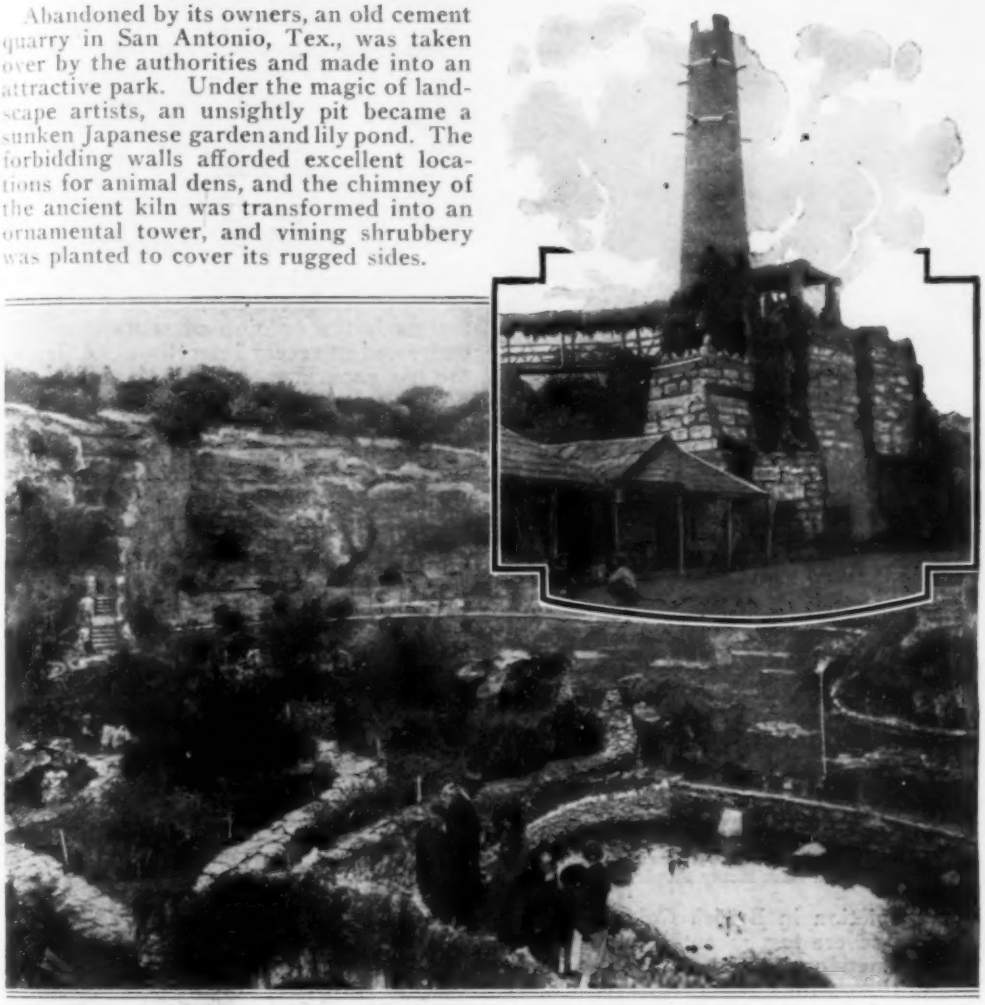
Doing the work of many men and horses in grading roads and clearing snow from highways, a grader run by a kerosene engine requires the attention of but one man when in operation. The machine may be fitted with flanged wheels for work in soft soil, or "crawler" treads, similar to those seen on "tanks," can be attached. Where it is operated on hard, level, surfaces, heavy rubber tires are employed. Detached implements can be furnished for grading, scraping and scarifying roads, or digging ditches. It can also serve to lift icy crusts from paved streets during winter weather. Its low cost of operation fit it for duty where economy is important.



Road Grader Operated by Kerosene Engine that Requires Services of Only One Man

ABANDONED QUARRY IS TURNED INTO CITY PARK

Abandoned by its owners, an old cement quarry in San Antonio, Tex., was taken over by the authorities and made into an attractive park. Under the magic of landscape artists, an unsightly pit became a sunken Japanese garden and lily pond. The forbidding walls afforded excellent locations for animal dens, and the chimney of the ancient kiln was transformed into an ornamental tower, and vining shrubbery was planted to cover its rugged sides.



Terraced Gardens and Ponds of Public Park Layed Out on Site of Abandoned Cement Quarry; Above, Old Kiln Whose Crumbling Chimney Was Converted into an Ornamental Tower

UNCLE SAM'S TEN-CENT STORE SELLS COPIES OF PATENTS

Although it is not generally known, Uncle Sam runs one of the biggest ten-cent stores in the world, selling printed copies of patents to the number of 200,000 every month. It costs six cents each to print them, fifty linotypes being kept busy eight hours a day all through the year on this work alone. The work costs around $1,000,000 yearly, which comes back into the treasury with at least $200,000 profit. In addition to the copies sold, two million extra are sent to libraries all over this country and to foreign countries in exchange. Also, there are held in the patent office, subject to sale, fifty million copies of various devices. These cost the government $3,000,000, and have a sale value of $5,000,000.

¶Popular Mechanics Magazine does not publish the name of maker or seller of any device described in its pages, but this information is kept on file and will be furnished free by addressing our Bureau of Information.

ARCH SAVES DAM FROM FLOOD, PREVENTING LOSS OF LIFE

Buttressed and braced with concrete, a high dam, of the multiple-arch type near-

Spillway of High Dam Braced by Concrete Arches that Held Back Heavy Floods

ing completion in British Columbia, was put to a severe test recently, when heavy rains tremendously increased the pressure behind the unfinished structure. A landslide carried away the penstock, so that the weight could not be relieved in the normal way, and the water rose so rapidly that the contractors, fearing collapse, ordered persons living on the flats below to flee to safety. But the structure defied the flood and was completed rapidly when the waters subsided. The strong arch construction of the dam was considered an important factor in preserving it.

DAMAGE WORKED BY FROST IMITATED BY SALT

To imitate the effects of ice and frost on building materials, the government bureau of standards has found that salt and high temperatures can be used to counterfeit the action of winter elements. During experiments with waterproofing compositions and protective mixtures for stone, a piece of lime rock was soaked in a salt solution. When the moisture was evaporated by heat, it left the pores of the stone filled with the crystals. As these expand when dried, they exert a pressure among the grains and pits of the rock similar to that of frost.

X-RAYS MADE BY GLOWWORMS

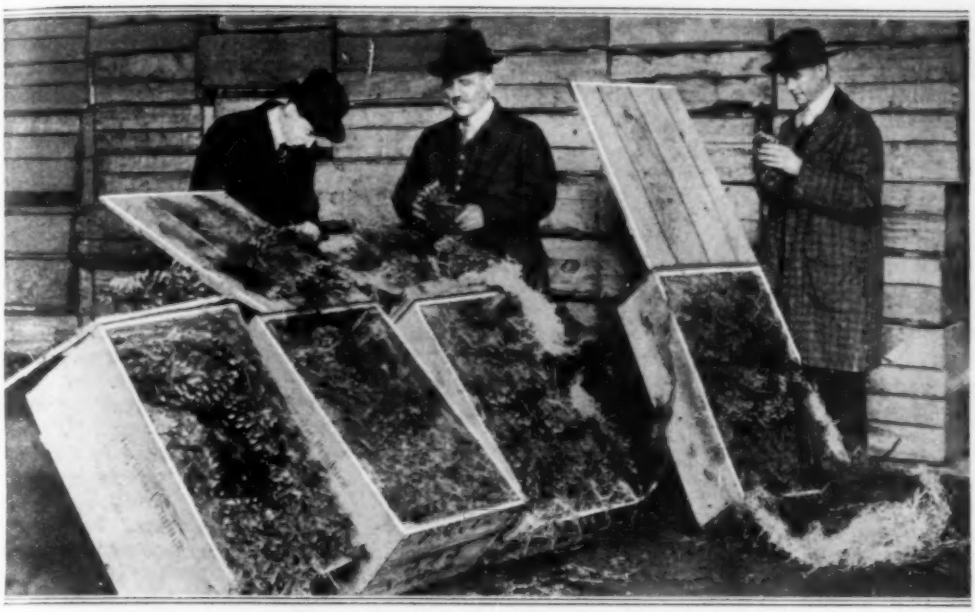
That properties peculiar to X-rays may be contained in the light emitted by glowworms is the opinion of some scientists, expressed in recent interviews. A Japanese has experimented with three hundred of the worms, and their rays, filtered through cardboard and copper plates, were said to have shown elements closely resembling those given off by various radioactive minerals.

COAL MINE FOUR MILES IN SEA

Coal is being mined under the sea for more than four miles from the coast of England. The veins are found to be 1,500 feet beneath the ocean floor and the field is about twenty miles along the shore and extends out for ten miles. Nearly a century ago, a mine owner contracted for the deposits, but only in recent years has the industry developed methods whereby the fuel could be extracted.

LAMP BENEATH HOOD OF AUTO KEEPS THE MOTOR WARM

To prevent automobile radiators from freezing and to keep the motor warm, a lamp designed to be conveniently inserted underneath the engine hood on winter nights, has been devised. It is safe and maintains sufficient warmth to protect the parts in low temperatures. Its initial cost is small, it requires but little oil and eliminates the difficulties of starting the car when the engine is cold.



Plant Experts Seeking Foreign Insect Pests

Army of Bugs Costs Farmers Billions

War on Hordes of Invading Pests from Abroad Keeps State and Government Scientists Busy the Year Round

By EARLE W. GAGE

ONE of the greatest wars the world has ever known continues, disarmament conferences to the contrary. Yet few realize the critical condition confronting the human family in this great combat of man against the enormous forces of injurious insects which attack us from every point.

The average person knows of neither the amazing number of these hordes battling against him nor of the army of trained men and institutions engaged in the struggle, but conservative estimates place the annual crop loss of the American farm at four billion dollars as a direct result of the onward march of the insects of the field. They have multiplied so fast that their present destruction of orchards, gardens, farm crops, forests and animal life is estimated to approximate more than $8,000,000 every twenty-four hours. Their havoc would be much more than this were it not for the work of the plant and animal experts of state and federal departments.

Spectacular and widespread destruction of crops is by no means the only harm worked by these pests. Their existence constitutes one of the chief hazards which the farmer encounters, bringing up his cost of production and ultimately the price which consumers must pay for their food and clothing. Experiments made by the scientists of the different states and the United States department of agriculture would indicate that the production of ten of the more important cereal, fruit and vegetable crops was reduced more than 650,000,000 bushels by plant diseases in a single year. In the same year, the cotton crop was reduced nearly 1,750,000 bales by the same agency.

Of all these insect hordes and diseases, there are relatively few that are native to America. Like many other harmful things, pests and diseases have trooped in after civilization, and have been carried in many ways from one country to another, until they have spread their destructive work practically over the world map.

Although many of the pests have come to us from Europe, Asia has contributed its share of them. Prominent among these for its destructive activities, is the San

Jose scale, which came to us from China and has now become widespread throughout the United States. This one little immigrant has cost the country upward of $200,000,000 for its board and lodging. Orchardists have been forced to make expenditures for apparatus and spray materials totaling about $10,000,000 a year to combat its ravages.

The Oriental peach moth, which came from Japan on a lot of imported cherry trees, has only started its spread and depredations. It affects practically all deciduous fruits, and bids fair to be as destructive as the well-known coddling moth, the cause of wormy apples, and which eats a large hole in our $300,000,000 annual apple crop.

The Japanese beetle has already gained such firm foothold that, in view of its habits and prolonged flight, it probably can defy extermination and may ultimately overspread the country. It attacks nearly all fruits and also many garden vegetables and corn.

The introduced diseases of forest trees, such as the pine blister, chestnut blight, and the enemies of the cereal and forage plants, are, however, vastly more expensive lodgers than those named, consuming

European Corn-Borer that Costs Farmers Millions Yearly

at least $1,000,000,000 worth of timber each year.

If the hundreds of foreign pests that have become permanent factors in American agriculture and horticulture, had been kept out, America would have enjoyed a tremendous advantage over the old world, says Dr. Charles L. Marlatt, of the federal horticultural board, who is in charge of the "Ellis Island" maintained by Uncle Sam to keep undesirable parasites out of the United States.

Insects at Root of Plant

The department of agriculture recently compiled a list of the dangerous insect enemies of plants in foreign countries which for the most part have not as yet gained entrance into the United States, and found there are some 3,000 of them, all regarded as menaces.

"Most of those already here have come in shipments of living plants, and many of them with florist and ornamental stock," Dr. Marlatt asserts. "In many instances the imported or ornamental, or other plant, has been a mere incidental carrier of the new enemy. For example, the European alfalfa weevil, which is reducing the output of alfalfa in half a dozen states, was introduced with soil in which was bedded imported plants sent to Utah, where it secured its first foothold. Other weevils of foreign origin, affecting clover and other plants, were similarly introduced.

Andean Potato Weevil

"Some enemies have come upon us in different ways: The Hessian fly with straw; the Argentine ant as a stowaway in a cargo entering New Orleans; the European corn borer with a shipment of broom corn from Italy."

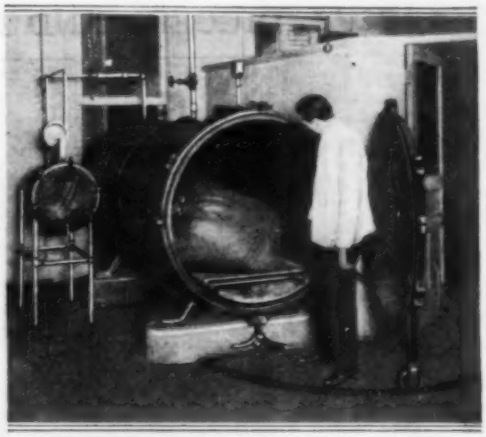
Some idea of the excellent work of the plant experts have been doing is indicated by their achievement for only a portion of this service. There were received from Holland 1,051 infested shipments, involv-

ing 148 kinds of insect pests; from Belgium, 1,306; France, 347; England, 154; Japan, 291; and Germany, 12.

The worst enemy the cotton plant has is the pink boll worm, the larva of a minute moth. The larvae feed in the bolls and destroy the forming lint. It came from India by way of Egypt some twenty years ago with importations of cotton. It reached Texas from Mexico, where it has reduced the growers' income by millions of dollars each year, while Congress has spent more than $3,000,000 in combating it.

To guard against recurrence of this, all cotton shipments from foreign countries are now subjected to the "third degree"—that is, the bales are put into a huge steel cylinder by means of a movable platform. The cylinder is hermetically sealed and the air exhausted, the vacuum assuring penetration of a disinfecting gas to the very center of the bale, destroying all insects that may be therein. Uncle Sam has the world's largest fumigating plant, and each cylinder has a capacity of more than 100 bales of cotton at one time, permitting a shipload of cotton to be treated in a few hours.

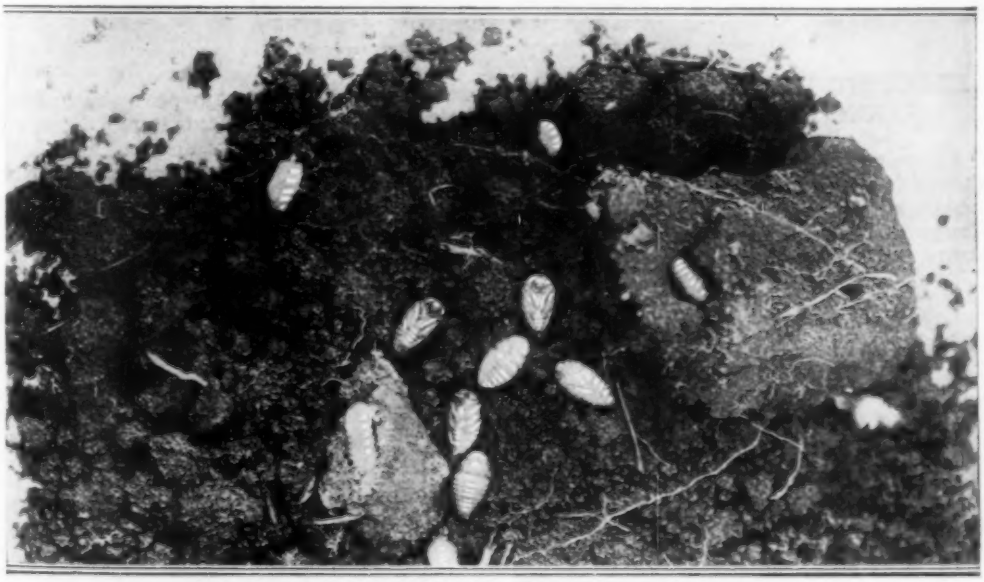
As our immigration officers must be on the lookout for smuggling, so the plant immigrant officials must watch for contraband importations. A woman custom inspector at Laredo, Tex., for example, took a bag of alligator pears, in which were found dangerous insect pests, from a woman's skirts. To the unaided eye, the appearance of a plant may be normal, yet



Vacuum Cylinder for Fumigating Cereal, Plant, and Cotton Shipments Received from Europe

when subjected to a powerful magnifying lens, millions of tiny eggs may be seen. This was found true of a recent importation of trees, having harmless-looking cracks in the bark, which the lens showed to be filled with the eggs of the camphor thrip, a pest which threatens failure to the promising camphor industry.

To combat these pests an army of government investigators is kept busy the year round. The work involves the development of a chemical means of warfare, the production of effective insecticides, the use of flames, the airplane to spread poisons and other mechanical measures. In addition, a rigid inspection service is maintained at every port of entry.



Japanese Beetle that Is Expected to Spread over the Country

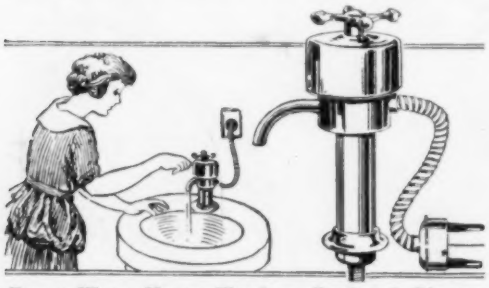
COAL DIGGERS AND DYNAMITE OUST HOMES

Steam Shovels Tearing Deep, Winding Excavation Along Streets of Residential City where a Rich Vein of Coal Was Discovered to Run Close to Surface of Ground

Steam shovels, locomotives, and dynamite have invaded a residential section of a Pennsylvania city to mine a rich vein of coal that was recently found under the district. Yawning gorges have been blown and dug into the earth at the sides of the streets, where the rumble of heavy machinery is punctuated with blasts of explosives. Great lengths of railroad track have been laid in a winding path through the neighborhood to carry the mined fuel away. Guard rails were built on the brinks of the deep openings to prevent accidents to unwary pedestrians. Thousands of tons of soil, rock, and anthracite coal have been torn from the land since operations began.

ELECTRIC HEATER ON FAUCET TAKES LITTLE CURRENT

Containing a small electric heater attached to a wall socket, a faucet which furnishes either hot or cold water has been designed. A cord in a flexible brass tube conveys the current from a wall plug. The device supplies a stream near the boiling point at the rate of twenty-five gallons an hour, and is especially adapted to home and office use. Electrical terminals are grounded in the water so that shocks are avoided. The appliance is economical, as it consumes electricity only when water is being used, is durable and easily installed.



Faucet Water Heater Fitted on Bowl and Diagram Showing Flexible Cord Socket Connection

EXPERT SAYS SCENTS OF GEMS SOOTHE OR EXCITE WEAKER

Some precious stones, such as the emerald, have been shown by experiments to give a pleasant, subtle scent when reduced to powder, while others, among them diamonds, have a disagreeable odor, according to a French expert. He declared that jewels influence the temperament and sentiments of those who wear them, some possessing a soothing effect, while others irritate.

TWENTY-SEVEN THOUSAND SHIPS NOW IN NATION'S FLEET

American ships in the merchant marine now number 27,017 ships, of 18,284,744 gross tons, according to the report of the commissioner of navigation. Engaged in foreign trade, there were 1,958 vessels, and in the coastwise voyages, 1,575 ships. Two hundred and ninety-eight vessels were lost during the year, 139 were sold to alien flags, and 628 abandoned. Minor officers and seamen shipped, reshipped and discharged during the twelve months were 583,110. Including those on government and commercial ships, there are now 21,967 transmitting radio stations in the United States, and over 2,000,000 receiving points.

SLEIGH ROAD INTO FAR NORTH TO OPEN NEW TERRITORY

Opening up a vast territory, heretofore unexploited by the white men or Indians, a sleigh road is being completed in British Columbia from Fort St. John to Fort Nelson, a distance of 170 miles. It is expected that this highway will reduce freight rates to the far north and will develop a great fur trade.

TRACKLESS TROLLEY COSTS LESS TO RUN THAN MOTOR BUS

Trackless trolley busses, having a seating capacity equal to that of single-decked motor coaches, are declared to have proved a success in both England and China. It is claimed that they are cheaper to operate than the gasoline-driven type and can compete successfully with surface railway lines. With extension collectors, the trolley busses have a radius of about fifteen feet on either side of the wires.

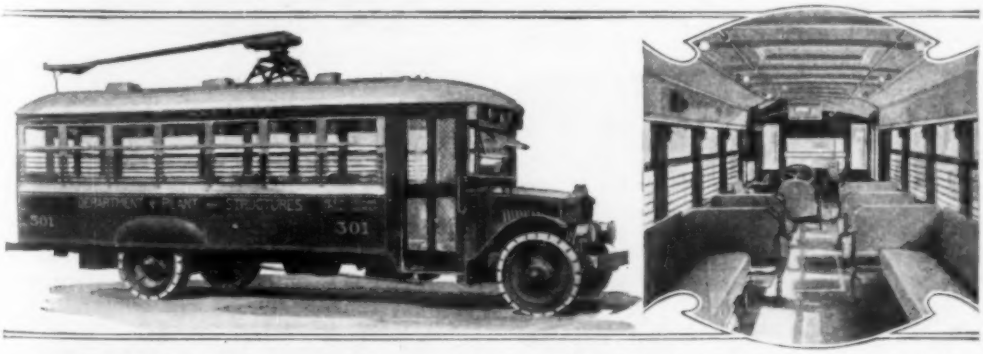
PISTOL DISCHARGE STOPS FIRE AT PULL OF TRIGGER

Shaped like a pistol, a fire extinguisher which shoots a forceful stream of flame-smothering liquid into a blaze at a pull on the trigger, has been invented and tested with favorable results in England. The instrument is noiseless, is handled easily and the heart of the blaze can be reached

Effective Fire Extinguisher that Works like Pistol to Shoot Stream into Flames

quickly by the concentrated jet which spurts to a considerable distance from the muzzle. The fluid is contained in cylinders loaded into the pistol. Because of its compact shape and small size it can be kept in a drawer for instant use. In a trial test, flames from a wardrobe saturated with oil were put out in a few moments by "fire" from the handy gun.

¶Rotting of wood is not due to the elements, nor to direct chemical action. It results from the activity of low forms of plant life which nourish themselves on the wood and thus destroy it.



Left, Trackless Trolley Bus that Has a Leeway of 15 Feet on Each Side of the Feed Wire; Right, Interior of Coach Showing Driver's Cab

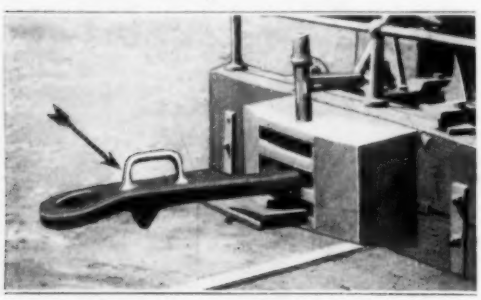
BLOCK RAISED ON STILTS TO BUILD STORES

Block of Houses Raised Fourteen Feet; Although Only an Inch of Space Separated the Structure from an Adjacent Building, the Movement Was Made without Affecting It

To make room for the construction of stores underneath a block of houses ninety feet long, and weighing 300 tons, engineers in Boston put jacks and timbers under the wooden structures and raised them to a height of fourteen feet. There was only about an inch of space between the houses and adjoining property, but so precisely was the raising done that the adjacent building was scarcely scratched. While the block rested on its stilts, brick walls and partitions for the stores were built up, and the wooden buildings let down upon them.

CAR COUPLER HANDLE GUARDS LIVES OF BRAKEMEN

Hazards encountered by brakemen on switch engines are lessened by a coupler with handles which help in guiding it into the lugs beneath cars and prevent it from getting out of control. With the ordinary type, a single miscalculation, or sudden jar, carried the danger of injury or death for the switchman.



Handle on Coupler Arm of Railroad Freight Car to Aid Switchmen in Avoiding Injury

"RAG MARKET" AND "FLEA FAIR" OFFER PARIS BARGAINS

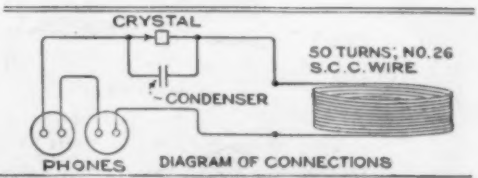
With all kinds of odds and ends neatly sorted into piles, the "Rag Market," is the Mecca of bargain hunters in Paris. In the olden days, it was called the "Flea Fair." There may be found rusty chains, keys, old clocks, parts of lamps, piles of rags and heaps of furs, for the most part too mangy to be touched, except with a stick or umbrella. Then, there is every possible kind of furniture, faded, tattered and scratched. The prospective buyers are composed of every class, from the poorest French to obvious sightseers and student bargain hunters, looking for an old bit of brass, a strip of embroidery or, perhaps, a mirror.

RADIO

Broadcasting Station Uses Novel Headset

WDAP, the broadcasting station of the Chicago Board of Trade, located at the Drake Hotel, Chicago, has a couple of novel headsets which are used to test the transmission from any point in the studio.

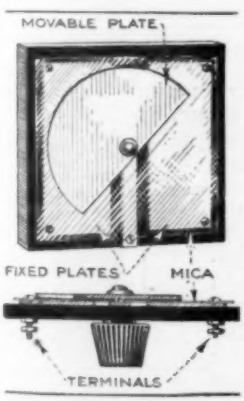
The set is a combination phone and receiver; the receiver unit is a 50-turn coil, wound on a bakelite tube firmly fastened to the headband, and connected to a small crystal detector screwed to a piece of wood spanning the top of the tube. With the headset on, the transmission of the concerts, lectures, etc., can be checked from any part of the studio or instrument room, without the necessity of sitting down at the standard receiving set. The connections are simple, and are shown in the upper detail of the illustration.



Above, Connections of Test Receiver; Left, View Showing Detector; Right, Headset in Use

Balancing Condenser for Loop Aerials

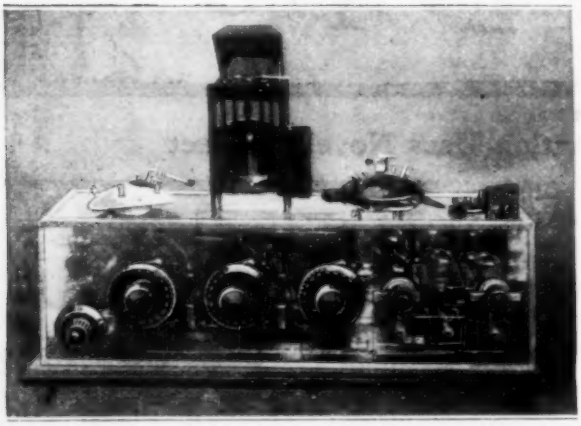
When using a loop aerial in orienting and directional experiments the capacity effect between the aerial and ground or near by objects often causes distortion and prevents an accurate minimum determination. A balancing condenser will usually serve to reduce this effect and facilitate accurate tuning. The condenser is preferably mounted on the loop and is made by screwing two sheets of thin brass on a piece of fiber or bakelite measuring 3 in. square. These plates are covered with a sheet of clear thin India mica, glued on. A semicircular washer made of sheet brass is attached to a rod, which is passed through a hole in the center of the panel, and is fitted with a knob at the other end. The movable plate is grounded, and the fixed plates connected to the ends of the loop. Rotating the knob will result in the balancing out of ground-capacity effects, and will improve the operation of the apparatus as a whole.—Thos. E. Benson, Philadelphia, Pa.



A Novel Transmission Experiment

Two seconds to travel fourteen times around the equator! It seems impossible, but that is the record of a signal recently sent from New York to Poland. The signal was sent to Warsaw, where it was made to actuate the transmitter and was reflected back to New York. On its return it was again reflected to Warsaw and so on, back and forth, each time with diminishing intensity, until at last, after forty double journeys, it became inaudible. Each double journey represented 9,000 miles, so that all told the distance traversed was close to 360,000 miles, or nearly fourteen times the distance round the earth at the equator. As wireless waves travel with the speed of light—186,000 miles a second—the time taken was approximately two seconds. Puck's promise to "put a girdle 'round the earth in forty minutes" was nothing to this.

Novel Exhibits at Hub Show

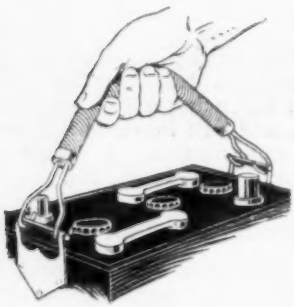


Group of Original Radio-Receiving Sets Shown at Radio Show in Boston

A group of novel radio-receiving sets was entered by amateurs in the Boston radio show. Among others were a five-tube neutrodyne set completely inclosed in glass, using the same material for the instrument panel, two crystal sets, one mounted on a clam shell, the other on a stuffed turtle, and a set mounted in a miniature phonograph cabinet, made by a 15-year-old boy. The novel sets attracted a great deal of interest from patrons of the show. The ingenuity of radio-set builders manifests itself in strange forms sometimes, but the surprising thing about it is that these freaks work, and usually work well.

Chain Carrier Aids Battery Users

Hitherto, the battery carrier has been a tool for use in service stations only, but with the vast increase in the number of individual users of storage batteries due to radio, one manufacturer has realized that a neat, light carrier would be of assistance to the radio fan, and has designed a very serviceable one. The carrier is made of strong chain, closely covered with flexible material that provides a comfortable grip, and provided with strong hooks on each end to engage the handles of the battery. This carrier will lighten the task of carrying the battery to the service station, or from the instrument to the charger, for recharging.



Ribbon Antenna Has No Advantages

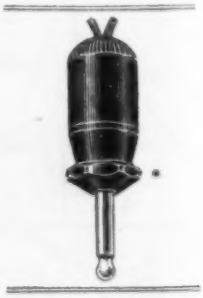
According to the Bureau of Standards, there is little advantage to be gained by the use of copper ribbon as an antenna. The ribbon aerial has been often recommended, especially for crystal sets, on account of its greater "skin effect," but the Bureau experts say that not only is this so slight as to be negligible, but that the ribbon is not so likely to be permanent as a wire aerial, due to the greater stresses to which it is exposed in sleet and wind storms.

Farmers Quick to See Merits of Radio

Surveys made by agents of the U. S. Department of Agriculture indicate that there are more than 150,000 radio sets on the farms of the country, or an average of about 54 per agricultural county all over the country. The farmer has been very quick to appreciate the advantages of radio for practical and social purposes, and has been one of the steadiest buyers of radio equipment.

Switch Plug Has Novel Features

Two headsets may be used at the same time, or either one alone, on a new plug. A headset and a loud speaker may also be attached to the plug, and tuning may be done by means of the headset, switching to the loud speaker simply by turning the knob on the plug. Headset and loud speaker can be used at the same time, or either one alone, through the 4-way switch. This will prove exceedingly convenient, as it not only saves the extra jack, but simplifies tuning and switching.

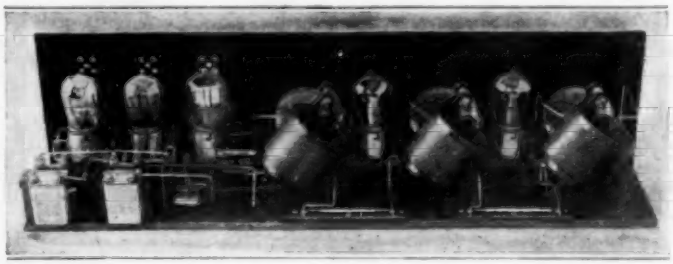


BUILDING A FIVE-TUBE NEUTRODYNE RECEIVER

By F. L. Brittin

Part II—Adjusting and Tuning the Set

THE secret of successful operation of a neutrodyne receiver lies in the accurate adjustment of the neutralizing condensers or neutrodons which are connected to the radio-frequency amplifying tubes. The adjustment consists in tuning the radio frequency tubes up to maximum signal strength in the usual way, then removing the tubes and insulating the filament-circuit prongs so that when the tubes are replaced in the sockets they will not light, and finally sliding the brass tube on the neutrodons to the position where the signals are reduced to minimum strength, or, if possible, entirely eliminated.



Rear View of Neutrodyne Receiving Set Showing the Arrangement of the Instruments

If there is a broadcasting station in the immediate vicinity the adjustments can be made while the station is operating, but if the nearest station is quite distant a buzzer circuit of the kind shown in the illustration is necessary. It is best, however, to use both methods and to check the results of one against the other before soldering the brass tubes on the neutrodons in their permanent positions.

The buzzer circuit consists of a dry cell, a 13-plate variable condenser, buzzer, push button, or better, a switch, and an inductance of 70 turns of No. 22 double-silk covered wire, wound on a bakelite or cardboard tube about 3 in. in diameter. This inductance applies only to wave lengths of 200 to 600 meters, which are used by the stations broadcasting music and popular entertainments. The connections must be accurately made according to the diagram, and the circuit is then hooked on the aerial binding post of the neutrodyne receiver set, while the ground binding post of the set is securely connected to a cold-water pipe, wherever most convenient. The buzzer apparatus should be placed about 10 or 15 ft. away from the receiver so that there will be no interference due to mutual inductance.

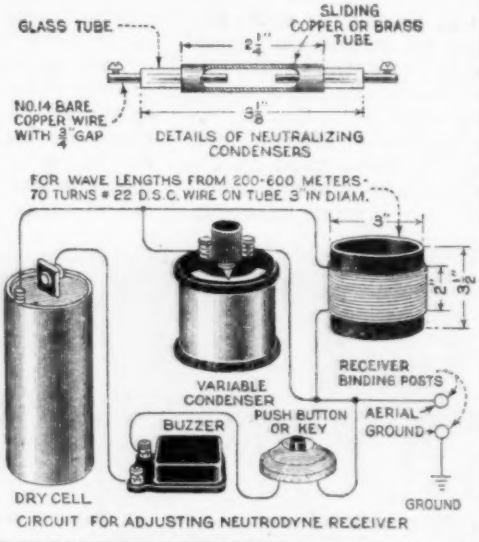
The neutrodon of the first radio-frequency tube, which is located at the extreme left-hand side of the set when facing the panel, is the first to be adjusted. Start the buzzer and push in the plug of the filament jack, which will light up the filaments of all the tubes when the vernier rheostat and the power rheostat are turned up; the latter, however, is not turned on at present. Push the phone plug into the phone jack and turn up the vernier rheostat to the point where a strong hissing sound is heard, which is the sensitive working point of the detector tube. Rotate all three dials of the neutroformers to the point where the buzzer signals can be heard loudest. As soon as this point is reached the dials will be in step, that is, they will all be turned to approximately the same point.

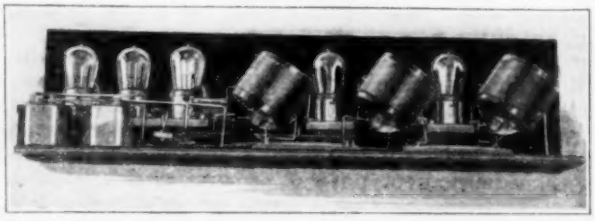
Now remove the first radio-frequency tube and slightly readjust all three neutroformer dials until the signals are again as strong as possible. Before replacing the tube, fix a piece of paper over the end of one of the filament prongs; these are the ones nearest the panel when the tube is placed in the socket. Small gummed labels are very handy for this purpose. To be sure that the prong is properly insulated, turn up the power rheostat a little, after replacing the tube in its socket. If

the tube remains unlit everything is in readiness to proceed and the power rheostat is turned off again.

With the filament circuit cut out, but the grid and plate still connected, it is necessary to reduce the strength of the signals or eliminate them entirely, which is done by moving the brass tube on the first neutrodon. When the signals are as faint as possible the first tube is removed from its socket and the signals will come in loud again, and by replacing it with the filament prong still insulated, the signals will again be inaudible or nearly so. This is the desired adjustment of the brass tube on the neutrodon, which should be permanently fixed with a drop of solder after its correctness has been carefully checked, and after the neutrodon of the second radio-frequency tube has been similarly adjusted.

The gummed label is taken off the prong and the tube reinserted in its socket, after which the filament circuit of the second tube is insulated with a gummed label and the second neutrodon is then adjusted in the same way as the first. Always see to it that the neutroformer dials are adjusted to maximum signal strength before adjusting the neutrodons to minimum signal strength.





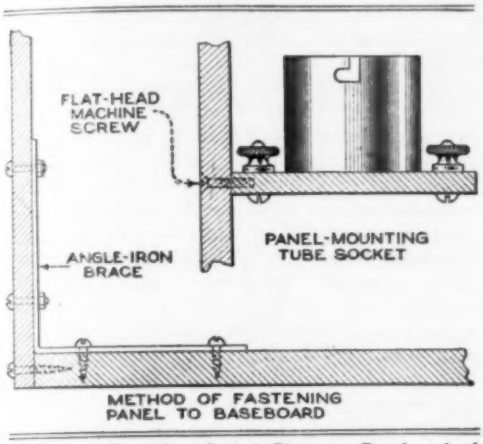
Above, Buzzer Circuit for Adjusting Neutrodyne Receiver. Upper Detail Shows Construction of Neutrodon; Below, Another View of Rear of Set

In adjusting the neutrodons it will sometimes be found that the signals strength can hardly be reduced. In such cases, it is necessary to connect the wire from the grid of the tube to the center clip of the neutrodon instead of the end where it is usually connected. This provides a greater capacity range for the neutrodon and permits the builder to get weaker signals.

As mentioned previously, it is a good idea to make tests with a local loud broadcasting station before finally soldering the neutrodons. Turn on all the tubes, with the instrument connected to the regular antenna, and pick up the broadcasting signals. By rotating the dials over the entire range it should be possible to receive the signals without any whistling, beat notes, etc., which indicate undesired oscillation. If such interference is heard, the entire instrument should be readjusted, taking each step singly as before, and it may be necessary to separate some of the wiring if the trouble persists.

The neutrodyne receiving set is tuned in a different manner from the ordinary radio receiver. First turn up the power rheostat to the correct position for the type of tubes that are used, and with the vernier rheostat turned off entirely, plug in the loud speaker or phones, and push in the battery plug in the filament jack, which will cause the filaments of the amplifying tubes to light. Then turn the vernier rheostat up slowly until a loud hissing noise is heard from the loud speaker or phones. Turn the vernier rheostat back just below this point, and turn the second and third neutroformer dials to about the same position. Rotate the dial of the first neutroformer very slowly until it reaches a point where the signals from a broadcasting station will be brought in. This point is usually about 10 or 15 degrees above or below the corresponding points on the other neutroformer dials. Carefully readjust these and also the vernier rheostat, to increase the strength of the signals. Tuning should be accomplished very slowly and not in a jerky manner. This is important to remember, especially when tuning in to long-distance stations. The second and third neutroformer dials are adjusted to the particular wave length of a broad-

casting station to which one is desirous of listening in, and the first neutroformer is adjusted to bring the signals in loudly



Method of Fastening Socket Bases to Panel and of Fastening Panel to Baseboard

and clearly. The second and third dials are then set to correspond with the first.

News May Be Broadcast to Army Men

Outlying naval stations and ships of the Navy have for some time been supplied with daily news through the Navy Press, which transmits from NAA at Arlington every evening. Army posts may have a similar service, if a scheme now under consideration by the War Department goes into effect.

Army posts at the Philippines and Hawaii would receive bulletins at least once a week from a high-powered station on the Pacific Coast. These bulletins would also be transmitted to forces stationed in Panama, Cuba, Alaska, and Porto Rico, and be picked up by isolated posts in this country. General orders to all posts might be announced by radio, to save the expense of cable and telegraph tolls.

Two-Element Tube Needs No B-Batteries

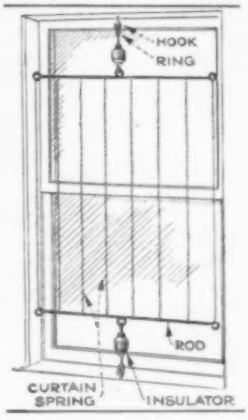
Makers of reflex-circuit sets will be interested in a tube that has recently made its appearance. The tube has but two elements, hence it name—the "diode." It is said to combine the clear reproduction of the crystal with the sturdiness and reliability of the tube, and to operate on less than ½ amp. from a single dry cell. No B-batteries are required. It is adapted for use in all reflex circuits, and requires no adjustments for changes in wave length.

Speedy Telegraph Service for Fans

One evening recently the editor of this magazine tuned in station WSD at Atlanta, Ga. The concert was so good, and reception so perfect, that he thought the station might like to know of it and immediately sent them a telegram. Twenty-five minutes later he heard his own message broadcast from the station. The speed of the telegraph service impressed him so much that he wrote a letter of commendation to the local superintendent of the Western Union, and received, in reply, another surprise. Not only was the twenty-five-minute service common, it was, in the opinion of the superintendent, exceedingly slow! Inquiry elicited the fact that, after a recent concert by the Chicago Board of Trade broadcasting station—WDAP—at the Drake Hotel, Chicago, a total of 4,400 messages were delivered in one night. Most of these came from districts within a radius of 500 miles, and the average time, from filing to delivery, from large centers where the messages did not need relaying, was 4 minutes. From small stations, where relaying was necessary, the average time was slightly more, but one small station sent a message, from filing to delivery, in 2 minutes! This is real service.

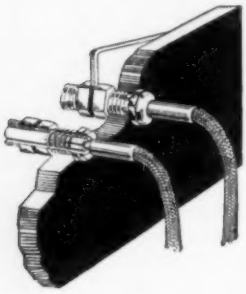
Simple Window Aerial

Various kinds of indoor aerials are advocated for buildings where any other type is impossible; one of the most effective is shown in the illustration. Two spreaders of heavy iron wire or light iron rod, a little shorter than the width of the window, are bent with an eye at each end, and one in the center. The two spreaders are connected with a number of the light curtain springs that are widely used instead of curtain rods. The efficiency of the aerial depends to a great extent upon the number of springs used. The spreaders are suspended between the top and bottom of the window casing, insulators being used as shown. The springs are drawn up tightly so that they will not touch each other, and the aerial will not swing.



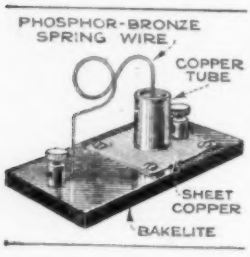
Phone-Tip Jacks Make Plugs Unnecessary

For plugging in as many sets of phones or loud speakers as desired, and connecting them either in series or in parallel, a new phone-tip jack will be found cheap and useful. No plugs are necessary, as the jacks fit all sizes of phone-cord terminals, and the installation is very simple; it is necessary only to drill a ¼-in. hole in the panel, insert the shank, and clamp the bus wire under the locknut. The contact made is positive, and the jack grips firmly, while at the same time permitting the tips to be withdrawn easily.



A Novel Crystal Detector

Crystal detectors of the usual type in use on radio-receiving sets have some drawbacks, which prove to be very annoying when a person is listening in to a broadcast concert. The "cat-whisker" wire has the disadvantage of being easily dislodged by slight vibrations, such as caused by a person walking over the floor. This throws the point off the sensitive spot on the galena, and stops reception in the midst of an interesting program. Very often it takes considerable time to find another sensitive place, and thus a good part of an evening's entertainment is lost.

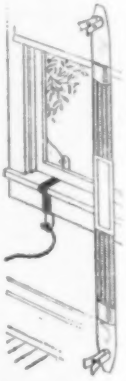


A detector that cannot be thrown out of contact is shown in the illustration. Instead of touching the crystal at only one spot, the wire is in contact with it at numerous points, as the crystal is pulverized, and any vibration taking place simply moves a different set of sensitive grains into contact with the wire.

The detector consists of a base, made of bakelite or similar material, two binding posts, a small copper sheet, a short copper tube, and a length of No. 20 or 22 phosphor-bronze spring wire. The copper tube is soldered to the sheet and the latter is attached to the base by means of small wood screws. The spring wire is bent to the shape shown and is attached to one binding post, while the other binding post is connected to the copper sheet. The tube is then filled with the pulverized galena or other sensitive mineral, to about ⅛ in. from the top. This is done with the use of a piece of paper creased in the center, allowing the grains to slide into the copper tube. The galena should not be ground too finely and must not be touched with the fingers, as the oil on the skin of the fingers is sufficient to make the particles nonconductive, which will stop the reception of music and of signals. It is surprising how this type of detector always retains contact between many sensitive grains, thus enabling steady reception, no matter how much vibration there may be. If a radio enthusiast has a number of dirty, but sensitive crystals in his laboratory, he can clean them by immersion in medicated alcohol, taking care not to touch them with the fingers after cleaning. This will save the expense of buying new ones, as these will be found to give just as good service as new crystals.

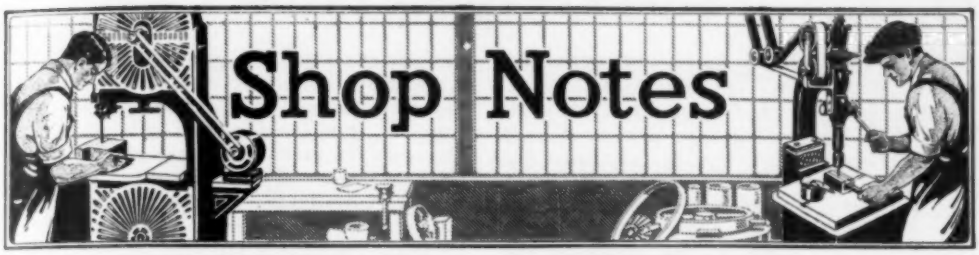
Lead-In Fits under Windows

Fitting under a closed window, a flexible lead-in now on the market should prove popular with radio fans. The lead-in is thin and flat, and can be bent to any shape to fit closely to the window ledges. It is covered with a fireproof, insulating material which prevents grounding of circuits on wet window sills, and eliminates the necessity of drilling holes and fitting porcelain tubes in the window frames. Tabs are provided at the ends for soldering the down lead from the aerial and the lead to the instrument. The fitting will prove of special benefit to radio enthusiasts living in apartments, where the drilling of window frames is usually prohibited.



Grid Leak Has Fine Adjustment

Eliminating circuit noises, moisture-proof, and nonmicrophonic, are the claims advanced for the latest variable grid leak. Each movement of the knob gives a definite resistance over a range of from ¼ to 10 megohms. The instrument is neatly designed and suitable for panel mounting.



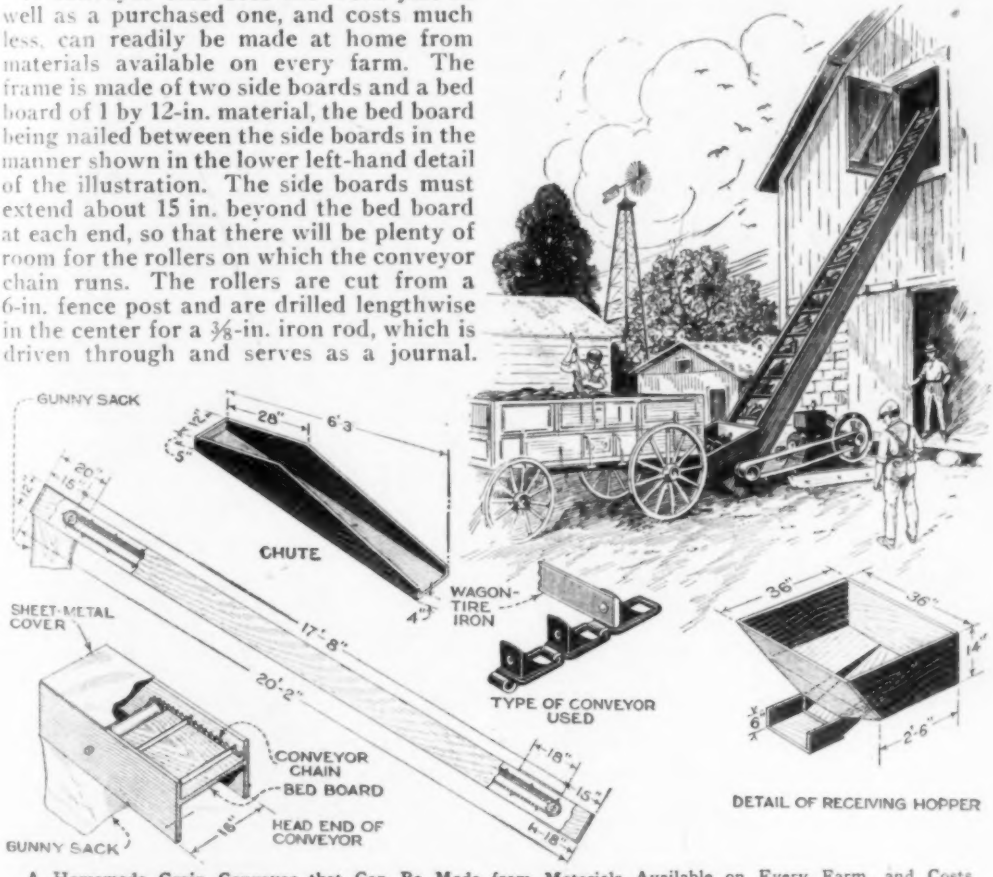
All Shop Notes published in 1923, in book form—from our Book Department.

A Cheap Grain Conveyor

By R. A. FRANKLIN

UNLOADING heavy grain sacks into the granary by hand is by no means an easy task and a conveyor for this purpose is of considerable usefulness. But, taking into consideration the price of a conveyor and the fact that it is used only a few days in each year, most farmers prefer the old method of filling their granaries by hand.

A conveyor that does the work just as well as a purchased one, and costs much less, can readily be made at home from materials available on every farm. The frame is made of two side boards and a bed board of 1 by 12-in. material, the bed board being nailed between the side boards in the manner shown in the lower left-hand detail of the illustration. The side boards must extend about 15 in. beyond the bed board at each end, so that there will be plenty of room for the rollers on which the conveyor chain runs. The rollers are cut from a 6-in. fence post and are drilled lengthwise in the center for a ⅜-in. iron rod, which is driven through and serves as a journal. Holes of the same size are drilled through the side boards and steel or brass sleeves used as bearings. The journal of the lower roller is extended on one side and a drive pulley is attached. A 2 or 3-hp. gasoline engine, belted to this pulley, provides sufficient power to run the conveyor. Sprockets of equal size are securely screwed to the ends of the rollers, and two chains, taken



A Homemade Grain Conveyor that Can Be Made from Materials Available on Every Farm, and Costs Approximately $18: It Is Run by a Two or Three-Horsepower Gasoline Engine

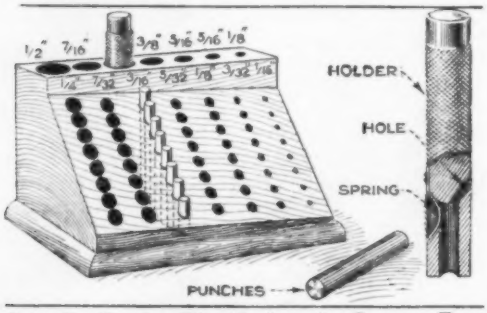
from an old silage-cutter conveyor, are run over the sprockets, and both ends of the chains connected to make them endless. Lengths of wagon-tire iron are straightened and used as crossbars of the chains; they are spaced about 1 ft. apart, and are bolted or riveted to the links of the chain as shown. The top surfaces of the rollers are flush with the surface of the bed board on the top side so that the chain will run snugly over the board and onto the rollers.

At its upper or head end, the conveyor is provided with a sheet-metal cover to prevent the grain from being scattered. A canvas gunny sack is attached under the head to receive the grain and direct it into a wooden chute, which in turn distributes the grain into the bins. This chute is made of 1-in. material and measures about 6 ft. in length; its shape and dimensions are clearly indicated in the detail. A receiving hopper, into which the grain can be shoveled from the wagon, is provided at the lower end of the conveyor; it is made of 1-in. boards and built as shown in the lower right-hand detail. Cleats are nailed to the side boards to hold the hopper in place. The grain shoveled into the receiving hopper is automatically taken up by the conveyor and discharged into the granary.

In building a conveyor of this kind, the cost was approximately $18, which is much less than the cost of a manufactured one. It was used during the threshing season for 8 years by the builder and his neighbors with whom he "changes work," and can still be used for many years.

Novel Drift-Pin Punch Set

Mechanics, especially those employed in the automotive industry, will appreciate a drift-pin punch set of the kind shown in the illustration. A set of this kind has been



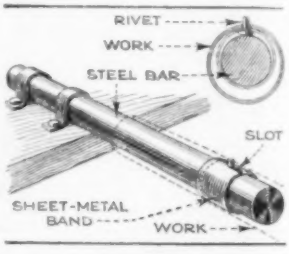
Drift-Pin Punches That Replace the Common Type, Which Are Easily Broken

used for 7 years and has been found to save considerable time and trouble, as cases are met hourly where cotter pins, straight pins, taper pins, etc., have to be removed as carefully as possible. After ordinary straight-drift punches were broken or bent, these punches were used and the work done without any trouble.

The punches are made of drill rod, hardened and drawn to a brownish-purple; they range in size from 1/16 to 1/2 in. in diameter, and are of varying lengths to be used progressively as the pin is driven out. Holders are provided for each size, of the same material as the punches, and hardened and drawn to a dark-blue color. The end of each holder is drilled as shown, a small hole being drilled through the side to permit the punches to be driven out in case of breakage. On the other side a slot is cut to take a spring that keeps the punches securely in place in the holder. A wooden block is drilled as shown to hold the punches and holders in an orderly way so that any size can be located without trouble.—S. H. Candy, Montreal, Can.

Riveting Sheet-Metal Pipe

Anyone who has riveted together sections of sheet-metal pipe knows the difficulties involved in placing and holding the small rivets, and will appreciate the following method, which has been found very practical. A sheet-metal band is made to fit fairly closely on the steel bar or stake on which the pipe is riveted, and a slot is cut in it as shown to hold the rivet. The two sections of pipe to be riveted are slipped over the bar, the ends brought together over the rivet and a hammer and rivet setter used in the usual way to force the rivet through the metal. It is surprising how much time can be saved by this method and how easily and neatly the work can be done.—L. H. Georger, Buffalo, N. Y.



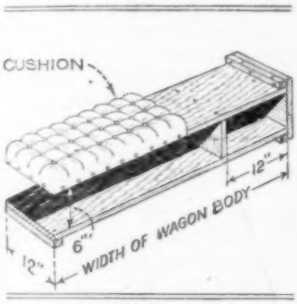
¶ To make a paint of dry white lead of the proper consistency requires about half its weight of linseed oil; dry zinc white will take nearly its own weight in oil.

Lubricant for Brass-Cutting Tools

Anyone familiar with copper and its alloys and other soft metals, knows that when chipping them, the chips tend to adhere to the surface of the tool and interfere with the cutting edges. The same is true when filing, drilling, and sawing. An excellent method of preventing this trouble is to use water as a lubricant. A can or tray of water is located near by so that the tool can be constantly dipped in it. The water avoids the gumming or clogging of the chips between the teeth of the saw, in the flutes of the drill, and on the surface of the file.

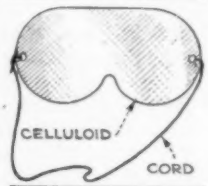
Simple Spring Seat for Wagon

Common farm wagons without springs do not provide much comfort for the drivers and therefore the simple wooden spring seat shown, which is constructed similarly to a spring board for diving purposes, will be greatly appreciated by teamsters and farmers. A seat of this kind can be made from two 1-in. boards about 10 or 12 in. wide and just as long as the regular wagon seat, and two 6-in. pieces of the same material. The long lengths are nailed to the short pieces, the short ones being spaced about 12 in. apart at one end. A pad or cushion on the seat provides additional comfort.—L. H. Unglesby, Baton Rouge, Louisiana.



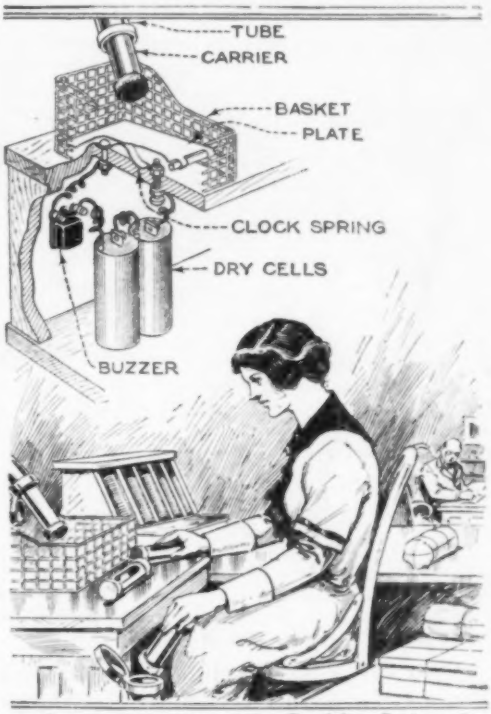
A Kink for the Auto Mechanic

Working underneath automobiles is usually a very annoying task as particles of dirt and grease constantly fall into the worker's eyes. This trouble can easily be prevented by using a pair of goggles, which can readily be made from a piece of celluloid, cut to the shape shown in the illustration. A piece of rubber or string is tied on, as shown, to serve as a headband.—William Calvert, Vickery, Tex.



Alarm for Pneumatic-Tube System

Persons familiar with pneumatic-tube systems in large stores realize the inconvenience caused customers by delay of the cashiers to open the carriers immediately when received, as it often occurs that they are allowed to lie in the baskets for several minutes before they are even noticed. This trouble was eliminated in a large department store by providing a buzzer which was sounded automatically by the weight of the tubes in the receiving basket. The arrangement is clearly shown in the illustration.



A Buzzer Connection to the Receiving Basket of a Pneumatic Tube Announces Arrival of Carrier

A sheet of brass is cut to fit inside of the basket over the bottom, allowing about ¼-in. space on each side, and three "fingers" are left on one end to hinge on a rod as shown. Two ⅛-in. holes are drilled through the shelf on which the basket rests, for stove bolts, and a short length of clock spring, attached to one of the bolts, is bent as indicated so that a slight pressure on the brass plate will cause it to touch the other bolt and thus close a circuit that sounds the buzzer. A carrier dropping into the basket immediately starts the buzzer, which continues to sound until the carrier is taken out.—Marshall W. Gelette, New Bedford, Mass.

Street-Cleaner's Dustpan

Municipal street-cleaning departments will find the dustpan shown in the illustration of considerable usefulness. It is simply a piece of heavy sheet metal, bent

Convenient Dustpan for Street Cleaners. It Can Be Swung Over and Emptied by Raising the Handle

to the shape indicated and hinged to the frame of the dust carrier so that it can be dropped when sweeping dirt onto it, then swung over and the contents emptied into the can. The can swings freely on the axle so that it is always in a vertical position. A flat-iron bar, which is attached to the handles and constitutes part of the frame, extends below the handles to support them when the cart is left standing.

Repairing Leaking Suction Pipes

Leaking suction pipes, whether large or small, can easily be repaired. In a government power house a 4-in. underground suction pipe, attached to a steam pump, began to leak at the ends of a coupling where the threads had become corroded. The earth was removed around the coupling and a wooden form built of 1-in. material. The form was 18 in. square, open on the top, and the ends were each made of two pieces and had a 4½-in. hole for the pipe to pass through. A mixture of cement and plaster of paris was then packed into the box around the leaky coupling and allowed to set for an hour, which was sufficient, due to the proportion of plaster of paris. Then the pump was started again and the leak was found to be effectively stopped. The cost of doing this was, of course, much less than the installation of a new coupling. Many mechanics forget that on a suction pipe there is no internal pressure, and that the only thing to guard against is leakage from the outside to the inside of the pipe. A knowledge of this fact will often save expensive repair jobs. —James E. Noble, Toronto, Can.

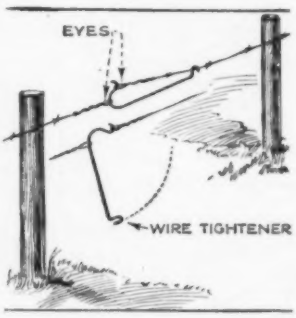
Tack Rag for Auto Finishers

A tack rag for automobile finishers can be made very easily by thoroughly saturating a piece of cheesecloth with rubbing varnish. Spread the rag out until almost dry, then fold and it is ready for use. By wiping off the car body or parts to be varnished with the rag all dust and lint will be removed, leaving a very clean surface.

As the tack rag is usually folded the danger of fire due to spontaneous combustion is always present, therefore it is a good idea to destroy all tack rags and scraps around the finishing room every evening and make new ones the following day. This can be done in a few minutes.—Vernon F. Clayton, Detroit, Mich.

Wire Tightener Acts as Gate

Although it is handy to have many gates on the farm, wooden gates are easily broken by cattle running against them, and steel gates are expensive. However, a simple homemade gate, which cannot be broken easily and is not expensive, is shown in the illustration. It consists of lengths of ½-in. iron rod, with one end bent to an S-shape, and the other end bent to form a hook. Each fence wire is cut in two, midway between two posts, and the ends are turned back and twisted around to provide eyes, which are hooked on the S-shaped ends of the rods. Then by bringing the other ends of the rods over the wire, they will be stretched just as tightly as before and will be held in this position securely, while the hooks are easily dropped to afford a passage.—Alphonse F. Wolters, Albany, Minn.



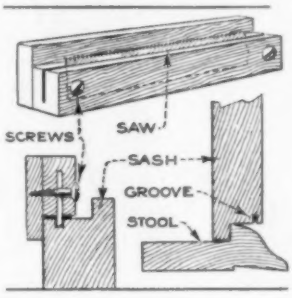
A "Pick-Up Stick" for Varnish Work

Automobile finishers find it very annoying to discover a nicely finished panel covered with lint, brush hairs, or dirt. If there is not too much of this, however, it can readily be removed by means of the "pick-up stick" described in this article.

Take equal parts of rubbing varnish and turpentine, mix thoroughly and place in a warm place near a steam pipe or stove. After a few weeks the mixture will be very gummy and may be rolled between the fingers like putty. Prepare a small ball of this and place it on the ends of a short stick, about 15 in. long. Before the varnish has set, or become too tacky, look it over carefully for dirt. Any particles can readily be removed by touching them lightly with the ball on the stick. If the varnish is too dirty it is the best policy to remove it and do the job over.—Vernon F. Clayton, Detroit, Mich.

Hand Groover for Casement Sash

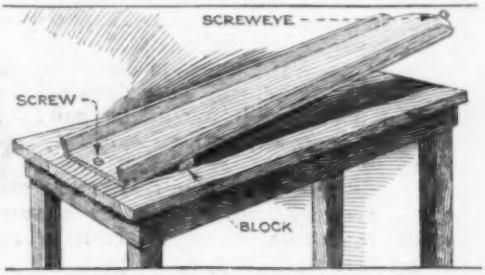
Grooving the bottom edges of a casement sash to form water drips is, at best, a slow and tedious job, but it can be greatly expedited by using the simple homemade tool shown in the illustration. It consists of a hardwood block about ¾ by 1¼ by 7 in. in dimensions, with a saw kerf 1 in. deep cut in the ¾-in. edge, about ¼ in. from one side. Make another block ¼ in. by 1¾ in. by 7 in. to act as a "fence," slip a 5-in. length of old compass-saw blade into the saw kerf, allowing the teeth to project about $\frac{5}{16}$ in., and drive a wood screw into each end of block and fence to keep the whole assembly together firmly. In use the fence is pressed against the outside of the sash and the tool slid back and forth, applying pressure to force the saw teeth into the wood.



Never put an inside patch in a slit tube, where the slit is over 1 in. long, because this will weaken the tube. However, when the slit is small, about ¼ in. long, an inside patch can be used. A slit tube should always be cut on the bias before repairing.

A Kink for the Cleaner

Intended for use in cleaning and dyeing establishments, the device shown in the drawing provides a quick and easy method of slipping bags over finished



Fixture that Aids in Covering Freshly Cleaned Clothing with Bags

work. In general appearance it greatly resembles a springboard; one end is fastened to the table by a screw or bolt, and a strip of wood is nailed under the board near the end, so that the other end is elevated a few inches above the table. The board is about 6 ft. long and just wide enough for the bags to be slipped over easily. Strips 1 in. deep are nailed to the sides, as indicated, and a large screweye in the end of the board completes the device. In use the clothes are laid on the board and the hanger hooked in the screweye, leaving everything ready for the bag to be slipped over the end of the board. When the bag is in place the hanger is unhooked from the eye, the hook pulled through the end of the bag, and the bag, with the work inclosed, is removed from the board.—A. C. Cole, Chicago, Ill.

Better Whitewash

When the main generating tank of an acetylene farm-lighting plant is cleaned, a milky, white liquid is drained out and thrown away as it is considered useless. This liquid makes excellent whitewash, however, which will not peel off like ordinary whitewash. It is applied in the same way if it is thick enough; if not thick enough it is allowed to stand in an open vessel until enough of the superfluous water has evaporated to give the mixture the right consistency. After application there may be a faint odor of acetylene left in it, but this will soon disappear. If two coats are applied the first should be thoroughly dry before the second is put on. The white material in this kind of whitewash is calcium hydroxide, which is practically the same as water-slaked lime, but more adhesive.

BUILDING AN EIGHT-INCH JOINTER

By J. V. ROMIG

A SMALL bench jointer makes a fine addition to the small workshop woodworking department, and the building of one that can be operated by a fractional-horsepower motor from a light socket presents no very great difficulties.

Where accurate work is necessary, a jointer is essential, and work done on the machine is finished in much less time than if done by hand, and with considerably less effort.

The jointer described in this article can be made easily and cheaply by anyone familiar with machine work. Happily, no castings are necessary, as all parts are of standard structural shapes, pipe, and flat and round bars, easily obtained and worked up.

The work table is made of 8-in. channel iron, of standard weight. The table is divided in two, the rear half being fixed, while the front section is mounted so as to enable the operator to adjust the depth of cut. The pedestal is of pipe, fitted with flanges top and bottom, as shown in the illustrations.

Simple and Easily Built Jointer for the Small Woodworking or Pattern Shop

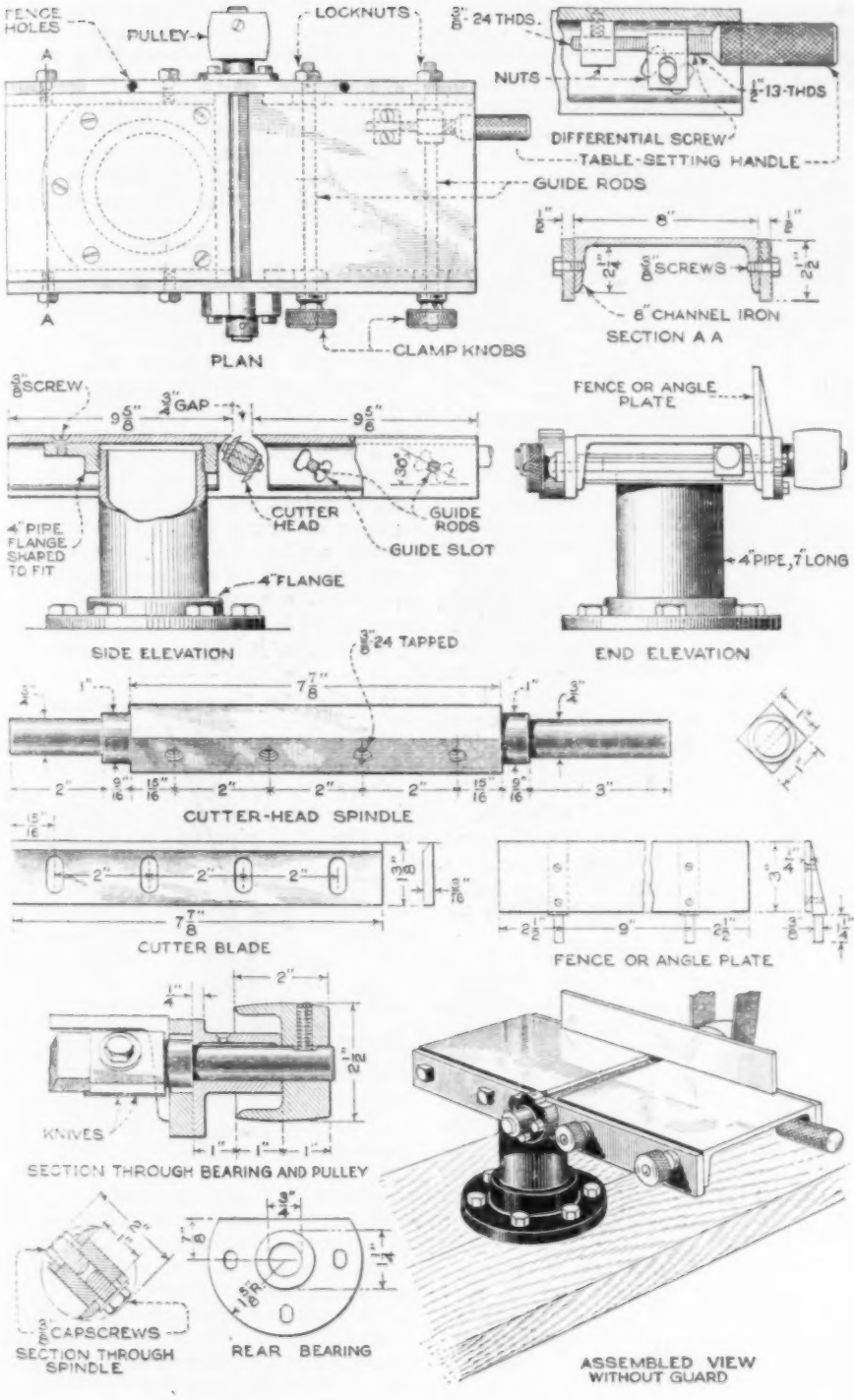
The table is first worked up, in one piece, if the channel selected is true and straight. A light cut is taken over the top and sides, to make them all square with each other. The channel is now cut in two, and the center edges curved to form the clearance for the cutter head, as shown in the side elevation. In order to lock the two halves in their proper relative position, ½-inch side plates, 2½ in. wide, are used, and these are screwed to the rear half of the channel as shown in the plan and section A-A. The plates are cold-rolled bars.

The mechanism used to elevate the front half is a differential screw, the table rising and falling on two guide rods passing through angular slots cut in the channel sides.

The rods are ½ in. in diameter, threaded on both ends. One end of each is screwed tightly into a hole tapped in the right-hand side plate, and fastened by means of a locknut. The other ends pass through clear holes drilled in the left plate, and carry knurled-head clamp nuts or knobs, which fasten the table tightly between the plates when the machine is being used.

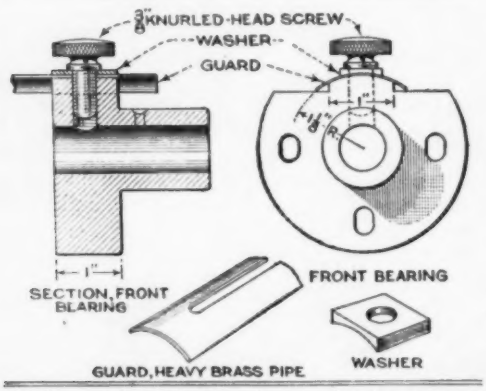
The holes are first drilled in the side plates, then the front half of the table is clamped in position with its top exactly in the plane of the rear half, and the position of the holes scribed through. This marks the exact location of the center of each slot. It is well to drill a few small holes on a line at right angles to each end of the slot, to provide room for handling the file when making the slots straight and true to size. It will be seen, by reference to the side elevation, that a movement of the front half toward the center will cause it to rise, and vice versa.

This motion is secured by means of the differential screw, riding in two nuts, as shown. One nut is screwed to the channel section, the other is slipped over the front rod. To compensate for the vertical travel of the table, the latter nut is slotted a little vertically. The first nut is tapped ⅜ in.—24 threads per in., the second ½ in.—13 threads per in. The screw is turned and threaded accordingly, and terminates in a long, knurled handle. The action of the differential screw is ideal for fine adjustments, as each turn advances or withdraws the table an amount equal to the difference between the pitches of the two threads.



Full Details of Construction of the Homemade Bench Jointer. No Castings are Necessary, and All Material is Standard, and Easily Obtainable

The cutter head is turned from a piece of 1-in. square cold-rolled steel to the dimensions shown. The center portion is left square, and to it are fastened the cutter blades, made of 3/16-in. cast-steel



Detail of Adjustable Brass Guard, Attached to Left-Hand Bearing

stock. The journals of the shaft should be exactly round and straight, and be highly polished to run easily in the bronze bearings. Next to the journals, a short portion of each end is turned to 1 in. diameter, providing a thrust surface to keep the head central in the bearings. The head is drilled and tapped for 3/8 in.—24 capscrews, which hold the blades. The holes are drilled and tapped through.

To permit the blades to be adjusted, the holes in them are slotted as shown, and the screws made with very short heads, to provide clearance. Thin washers are used below the heads.

The bearings are made of bronze-bar stock, and the bearing holes are elongated slightly to permit adjustment of the height of the cutter bar. The left-hand, or front bearing is slightly different from the rear one, to allow a guard to be attached. The details of the guard are shown so clearly that no description is necessary. The cutter head is driven by a 2½ by 2-in. pulley fastened by a 3/8-in. headless setscrew. The pulley may be turned from the solid, from steel or cast-iron bar stock, and should be crowned slightly.

The pedestal is made of 4-in. pipe, screwed into two flanges, as shown. The flanges are screwed on very tight, and a freshly made mixture of litharge and glycerin should be applied to the threads before screwing up, to make the joints as tight as possible. The upper flange is shaped on three sides to fit in the channel, and the latter is fastened to it with five 3/8-in. flat-head screws.

The fence or angle plate is made of ¼ by 3-in. flat-steel stock, and is fitted with two supports or braces with round ends, which are a neat push fit in the right-hand side plate. The surface of the fence must be exactly at right angles to the table top.

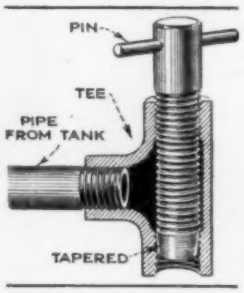
When finished and assembled, all non-working surfaces should be painted or enameled, leaving the machined surfaces bright.

Paste for Pipe Joints

A mixture of soap and graphite painted on the threads of the filling plugs of gasoline tanks makes them easy to unscrew. The mixture will last longer than any kind of oil or grease, as these are quickly cut by the gasoline, while the soap and graphite mixture is not so readily affected. This mixture can also be used to make tight joints on gasoline pipes and it is easier to break joints made with it than when made with the mixture of litharge and glycerin generally used for this purpose. A mixture of Portland cement and oil applied to pipe threads also makes a tight-fitting joint on cold-water pipes.

An Improvised Faucet

In an emergency a faucet good enough to control the flow of liquid from a tank where the pressure is not great can be improvised from a tee and a short length of threaded pipe to fit. The side outlet of the tee is screwed onto the pipe leading from the tank, and the short pipe, after threading, is tapered on the end so that it jams against the threads on the bottom of the tee, when tightened up. The faucet is completed by drilling a hole through the pipe near the top and driving in a pin. If no machine is available for tapering the pipe and drilling the hole, the first operation can be done with a file, continuing the work until the pipe shows a bearing mark all around where it touches the threads in the tee, and the second can be done by filing a slot on the top and driving in a flat handle instead of a round one. A faucet of this kind takes little time to make, and will answer for many tanks where ordinary faucets are used.

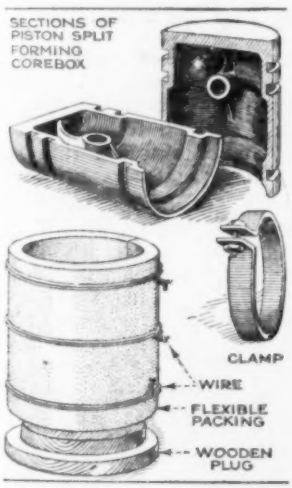


Bar for Unscrewing Gas-Tank Plug

Threaded plugs on tank trucks used for handling gasoline often become so tight that it requires considerable effort to unscrew them, making the use of some kind of a bar necessary. A good bar for this purpose is a length of ½-in. round iron or steel rod, about 16 in. long. The bar is forced into a length of ½-in. rubber hose, a little longer than the bar. This makes the rod less likely to slip, and it is apparent that dangerous sparks cannot be struck with a bar thus protected.—B. E. Dobree, Victoria, Can.

Old Piston Used as Pattern

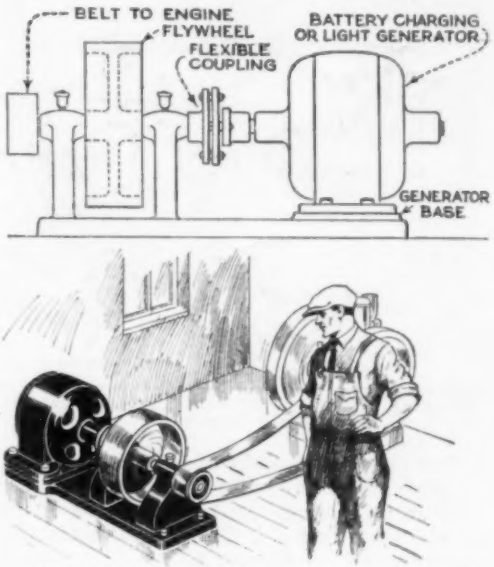
Occasionally it is necessary to replace pistons on "orphan" cars, and unless the piston happens to be of a standard size that is used by other makes of cars, it must be made specially. However, the expense of patterns and coreboxes can be eliminated by using one of the old pistons for making the molds. The piston is cut in half lengthwise as shown. The two halves are held together with a flat-iron clamp, while ramming up the core. Facing is provided on the outside by means of a layer of flexible packing or other material about 3/16 in. thick, tied securely with twine, and the impression is made in the flask after closing the open end with a circular wooden disk. The venting of the mold and provision for risers are details that are carried out in accordance with the regular procedure. It is also possible to core the wristpin hole, although it does not matter much as drilling this hole does not take very long.



Uniformity in weight of the finished piston depends much on the coring inside, and therefore the cores should be made as uniform as possible. The piston heads may vary a little in thickness but this can be remedied by turning down the top of the piston.

Flywheel Prevents Light Fluctuation

When small gasoline engines, especially those of the hit-and-miss governed type, are used for running lighting generators, they will, even if provided with heavy flywheels, cause more or less flickering of the lights, due to their irregular speed. This trouble can be lessened considerably by providing an additional flywheel, coupled to the generator shaft as shown in the illustration.



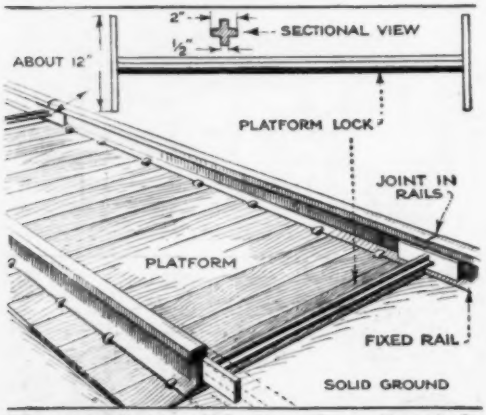
Additional Flywheel Added to Generator Prevents Flickering of Lights

A cast-iron base is made for both generator and flywheel, the flywheel being supported separately so that little strain is exerted on the bearings of the generator. The shafts of both flywheel and generator must be in perfect alinement and should be connected by means of a flexible coupling. The flexible coupling can be of stock pattern, or made by bolting heavy leather or fabric disks between two flanges. The flywheel, which should be smaller than the engine flywheel, and run at a greater speed, is very effective in keeping the speed of the generator constant.—H. H. Parker, Oakland, Calif.

¶ To prevent a graphite crucible, or any other kind of crucible, from scaling, keep it in a warm, dry place. Never place a new crucible directly in the furnace without first allowing all the moisture to dry out. Before using it, place it upside down in the furnace, and heat until red, then turn over and use for the regular melt.

Platform-Scale Protector

When a car loaded with several tons of castings was pushed across a small platform scale, the capacity of which was far



Protecting Platform Scale from Loads Beyond Its Rated Capacity

below the total weight of the castings, the result was a broken set of knife-edges. Still it was necessary to keep this scale on the main line of traffic to weigh certain castings at long intervals.

To keep the platform from deflecting when the heavy loads passed over it, two I-bars were fitted snugly between the head and base of the rails, at the joints between the movable platform rails and the fixed rails. The bars were steel castings, with heads ½ in. thick and 12 in. long, and the connecting bars were cast in the form of a cross, as shown in the sectional view. Whenever it was necessary to use the scale for weighing, the I-bars were slipped past the joint so that the platform was free to move up and down.

Correcting List in Auto Body

Listing of automobile bodies on one side is a natural consequence of the constant weight of the driver on this side. Other contributing causes are the torque of the engine and heavy jars on this side due to dropping into a hole in the road. Some manufacturers take these factors into consideration when making the springs by adding to their thickness and curvature on one side to compensate for this tendency. On closed cars the listing seems to be more pronounced after a short period of use, and this deducts considerably from their value.

A simple method that will effectively cure listing for a long time on transverse springs, such as used on the Ford, is to turn the spring end for end, and tighten well the center bolts that hold the body on the springs. In the case of semielliptic or cantilever springs, the rear springs are transposed, and if necessary also the front ones. A spirit level is much more dependable than the eye in determining whether the body is level or not.—G. A. Luers, Washington, D. C.

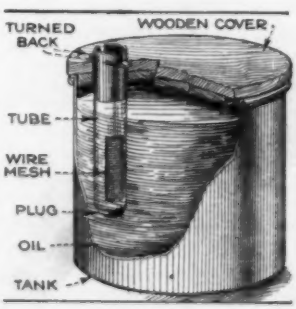
Stopping Dirt in Varnish Jobs

The following kink will be found invaluable to automobile finishers and finishers of fine furniture, as it reduces dirty-varnish jobs to a minimum.

With a ½-in. camel's-hair brush, apply a coating of light-bodied and pale shellac around the door openings, body moldings, windshield stanchions, and in all places where dirt or pumice stone are apt to lurk, before varnishing. In this way the dirt present, which should be as little as possible, will be held in one place rather than be brushed over the large panels where it will be readily noticed.

Oil-Hardening Pan for Small Work

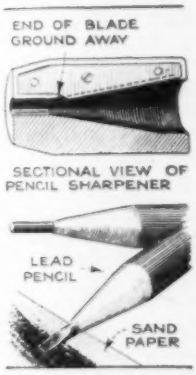
An oil pan for hardening small pieces in oil is shown in the illustration. It was made to overcome the difficulty of cooling such work quickly enough to harden the entire surface. To accomplish this the work cannot be held in tongs or pliers while dipping, and if simply dropped in the oil tank the result is just as bad because the oil immediately surrounding the work becomes hot, which delays the cooling and tends to leave the pieces soft. The round oil tank illustrated was fitted with a wooden cover, made up of two thicknesses of wood nailed together and rounded off, the bottom piece fitting inside the tank and the top piece on the edge. The pan in which the work is held consists of a length of 2-in. tube, the bottom end of which is plugged, and the top end slotted with a saw and turned back to form supporting ears. Two rectangular holes are cut in the side as shown, and a piece of wire mesh is inserted



to cover them. A hole is drilled in the cover near the edge for the tube, and the small heated pieces are then dropped in the tube. The cover is then revolved quickly so that the oil will circulate freely through the tube and in this way the entire surface of the work is exposed to constantly changing oil, which makes for proper hardness. When removing the pieces the tube is lifted out slowly to allow the oil to drain.

Pencil Sharpener Adapted for Draftsmen

Pencil sharpeners of the ordinary type do not give the lead the chisel-like edge that is required by draftsmen. By a slight modification, however, these sharpeners can readily be adapted to cut down the wood to suit the draftsman. This alteration consists in enlarging the small hole at the narrow end of the sharpener to a diameter equal to that of the pencil lead, and grinding away the edge of the cutter blade at that end so that it will only cut the wood of the pencil and not touch the lead. The lead end can then be rubbed down to a chisel edge on sandpaper. Pencils sharpened in this way look much neater than if sharpened with a knife, and there is no danger of breaking off the exposed section of the lead.—C. A. Oldroyd, Barrow-in-Furness, England.

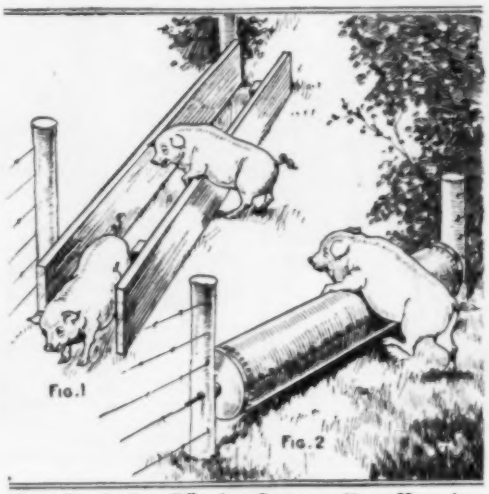


Adding to Convenience of Pipe Wrench

It is often impossible to use pipe wrenches in "tight" places because the movable jaw is too large to get behind the pipe. A good method of remedying this trouble was devised and used in the pipe-fitting department of the U. S. Navy Hospital at Portsmouth, N. H. An extra jaw of the same size is obtained and the head ground down as shown in the illustration. It is then substituted for the regular one in tight places and will be found to be of considerable assistance. Of course, this jaw will not be as strong as the other and therefore it must be used with care.—L. E. Fetter, Portsmouth, N. H.

Hog-Proof Gates

It is common practice to run hogs in the same field as cattle. To allow the cattle the liberty of passing into adjoining fields and at the same time prevent the hogs from doing so, a special kind of gate is required. Two types of such gates, that have been found very effective, are shown in the illustration. Fig. 1 shows a gate consisting of two wide planks, one nailed to the gate post and the other arranged parallel to it, with a space of about 2 ft. between. The second plank is nailed to strong stakes that are securely driven into the ground. The hogs can climb over this plank because they can approach it at right angles, but cannot get over the other because the second is so close. A hog (this has been proved many times) will usually climb over the first plank into the chute, and run along it back into the yard, thinking, apparently, that it has accomplished its purpose.



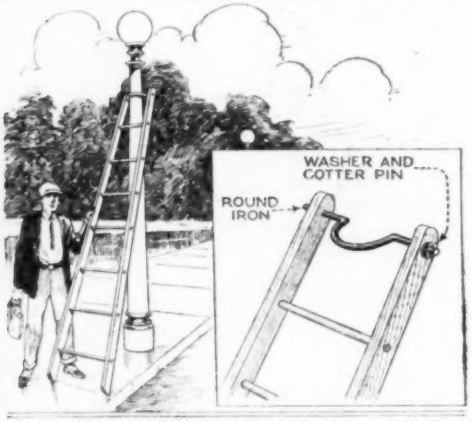
Two Simple but Effective Gates to Keep Hogs in a Pasture

An equally effective gate, which involves the use of an old hot-water tank, is shown in Fig. 2. It is drilled in the center at each end for a heavy gas pipe or iron rod, which is also passed through the gate posts as indicated, allowing the tank to rotate freely. The hog can get on the tank as indicated but the moment the hind legs are clear of the ground the weight on the tank causes it to turn and the hog promptly returns—a rather provoking situation for the hog, but it works.

¶A dull milling cutter wears out faster than a sharp one and does poor work.

Safety Rung for Ladders

Lamp trimmers, painters, and electricians, who are required to use ladders to ascend steel poles, will find the device

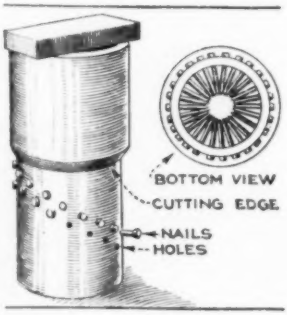


A Curved-Iron Rod Ladder Rung Prevents Ladder from Slipping to One Side

illustrated to be very effective in preventing the ladder from slipping over to one side. The device is simply a length of 1-in. iron rod, bent to the curvature of the poles and substituted for the top rung of the ladder. It is allowed to swing freely but is securely held in place by washers and cotter pins as indicated. The bar will immediately adapt itself to the pole and the danger of the ladder slipping sidewise is eliminated. This method was used by the painters of a traction company to paint bands on the poles, designating car stops.

Cutting Nail Heads

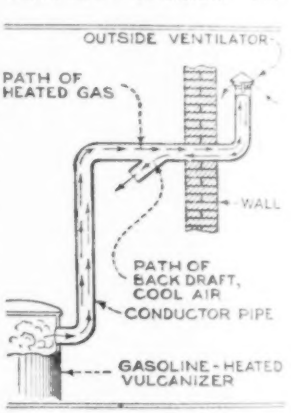
Common wire nails with the heads removed often make excellent pins for various purposes. When a sufficient number of such pins are required the operation of cutting off each head with the cutting pliers is much too slow, and a quicker method of doing the work is necessary. A device with which a number of nails can be cut in a few seconds is shown in the illustration. It consists of



two short lengths of steel tubing, one piece a neat sliding fit inside the other. The internal piece is drilled with rows of holes to fit the nails, the holes being laid off in spiral lines as indicated. One end of the external piece is ground to a sharp cutting edge and casehardened. The internal tube is loaded with nails pushed in the holes from the outside and the external tube dropped over it. Then a piece of metal is placed over the top, and the tube pressed down in a drill press, arbor press, or screw press. A press is used in preference to a hammer, as the pressure is applied steadily and evenly. With the holes in the internal tube laid out as shown, only one head will be cut at a time, so that very little pressure is required.

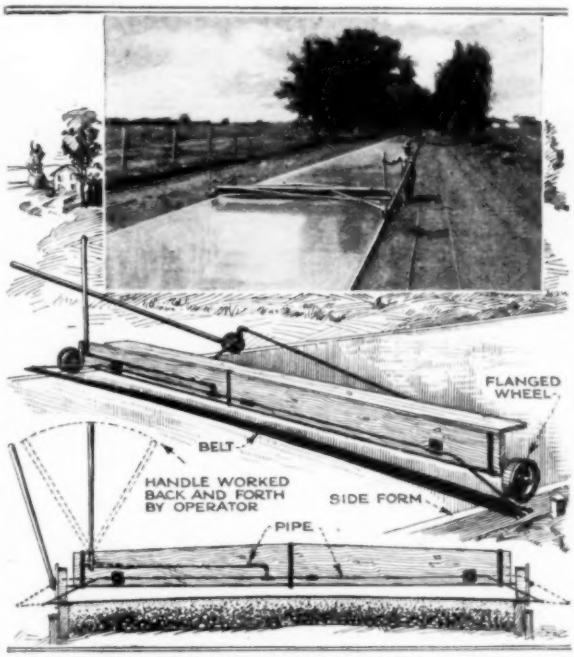
Preventing Back Draft in Ventilating Pipes

Type-setting machines, vulcanizers and other machines employing gasoline burners for heating require some outlet for the fumes in order to keep the atmosphere of the room in a healthful condition. The most effective arrangement is to connect the heating appliance with a chimney, but as this is often impossible many shops employ a small pipe which is allowed to project through the wall or a nearby window. There is, however, a disadvantage in this arrangement, in that there is often a back draft which causes the fumes and smoke to fill the room and also extinguishes the flame in the burner. This trouble, which was experienced in one shop, was remedied by inserting a Y-joint in the length of pipe so that the lower branch opened into the room as shown in the illustration. This did not materially interfere with the draft of the pipe but the back draft of cold air entering from the outside naturally flowed along the bottom of the pipe and was conducted out into the room as indicated by the arrows. The gases, being warmer than the incoming air, maintained a current along the upper side of the pipe and passed out without interference.



One-Man "Belter" for Concrete Road

The usual method of finishing a cement road is to "belt" it. This is done by drawing a heavy piece of canvas or rubber belting, a few feet longer than the width of the road, back and forth across its surface, the work being done by two men, one at each end of the belt. A simple device which requires only one man for this operation is shown in the illustration.

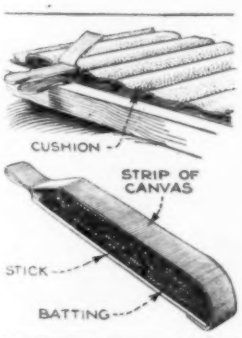


Homemade "Belter" for Concrete Roads, Moved and Operated by One Man

The device consists of a pipe frame mounted on three wheels, somewhat similar to the hand-power speeder used by signal men on railroads. The belt is swung from a length of pipe, which is bent to the proper shape, and mounted in bearings on a wooden cross-piece, and the transverse motion of the belt across the surface of the pavement is obtained by means of a lever at one side of the frame. As the belt is worked back and forth by means of the lever, the whole frame is pushed ahead on the wheels, which ride on the edge of the side forms; the stakes that hold the forms are driven down a trifle deeper than usual to clear the flanges of the wheels. The pipe frame supporting the belt is so pivoted that it can be swung up clear of the surface when moving the entire device backward or forward to a new position. The frame also supports a bridge by means of which the finisher can reach any part of the pavement without stepping on the soft concrete.—T. J. Harris, Chicago, Illinois.

Simple Upholstering Tool

One often wonders how the plaits in automobile upholstery are stuffed so evenly and without the lumps usually found if the work is done by hand. This is accomplished by using cotton wadding inserted under the plaits with the device shown in the illustration. This is merely a hardwood stick slightly narrower than the plaits, with a strip of canvas or similar cloth of the same width tacked to the end. Several thicknesses of cotton wadding are piled on the stick, the canvas strip is then pulled back tightly over the wadding and the device is inserted into the plait. A second piece of wood of the same width is inserted under the canvas to press the wadding down while the other piece of wood and the canvas strip are removed.

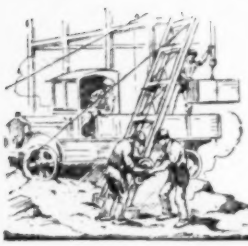


Repairing Large Rubber Stamps

It often occurs that one letter of a large rubber stamp is spoiled and this leaves the whole stamp useless. However, the stamp can easily be repaired and this will save the price of a new one. A piece of smooth leather belting of suitable thickness is obtained and a letter cut out of it, as near a duplicate of the broken one as possible. By trying the stamp out after inking it and making an impression the high spots can be noted. These are then rubbed down by means of a piece of pumice stone.

MECHANICAL POWERS

By CARL W. MITMAN
Curator
DIVISIONS OF MINERAL AND MECHANICAL TECHNOLOGY
UNITED STATES NATIONAL MUSEUM



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FOR many months the National Museum in Washington has been designing and building an unusual set of models of remarkable interest. These illustrate most simply and clearly the fundamental principles of the various Mechanical Powers. These models show at a glance, what textbooks have heretofore taken pages to describe. This is the first of a series of articles by Curator Mitman—who is himself an engineer of great ability—which not only explain in simple language what every mechanic and inventor who designs or builds a machine must know, but also tell how any one can exactly duplicate for himself the complete identical set of models in the National Museum. Mr. Mitman tells how to do this with ordinary tools and at practically no expense for materials.

For schools teaching physics or manual training, the opportunity is now presented for the first time of duplicating the set of these models in the National Museum. If one or more classes each year will build a few of the models, which should bear the nameplate of the class, in the course of two or three years the school will possess not only lasting monuments to the classes, but acquire, without cost, the full set for use of all future students, and which can be available to all local mechanics and inventors for all time.

These articles, which will run through many months to come, are being published for the first time and should be preserved for future reference.

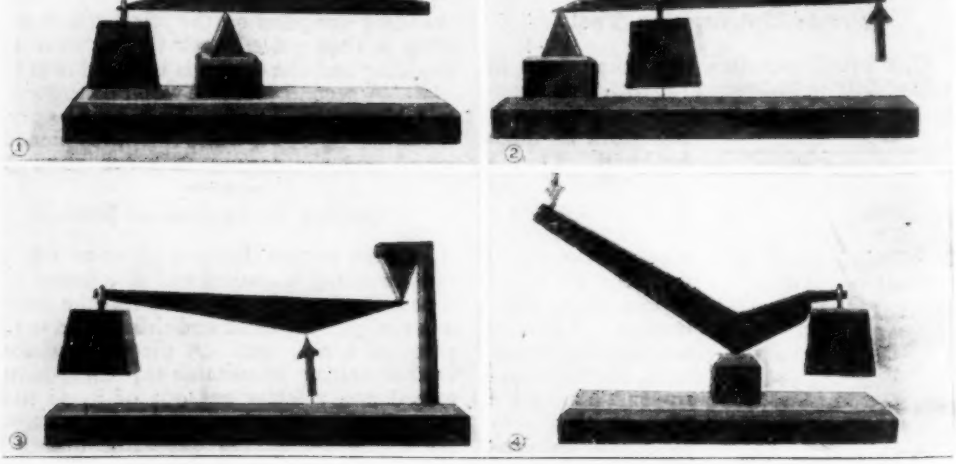
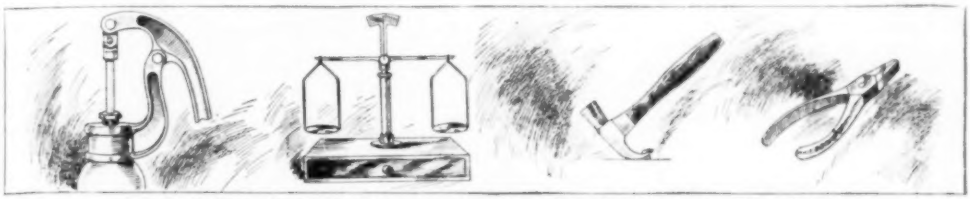


Fig. 1, Completed Model of First-Order Lever; Fig. 2, Model of Second-Order Lever; Fig. 3, Finished Model of Third-Order Lever; Fig. 4, Model Illustrating Angular Lever

Part I—Simple Levers

MECHANICS treats of the action of forces, and their effect. A force is usually defined as any cause tending to produce or change motion. It has only one element, namely, the push or pull exerted. Work, on the other hand, is the result of two elements, force and motion, and work done is the product of force and distance. The mechanical powers, the lever, pulley, screw, etc., depend for their action upon a fundamental principle of mechanics known as the "principle of work." This states that, disregarding friction and other losses, the work done by an applied force always equals the work done against the resisting force. To illustrate this principle consider a lathe in operation. A force, such as the pull of the driving belt, is applied in a given direction at one or more points. The product of this force and the distance through which it moves measures the work that is put into the lathe. The applied force is transmitted to the point where the operation is to be performed (the chuck), but in its transmission the force is changed in direction and amount both by the arrangement of the gearing and by the resisting force of friction, all of which the applied force must overcome. Now, at the chuck the original force, somewhat modified, overcomes a further resistance in any required direction, for example, the resistance of metal, held by the chuck, to a cutting tool. The product of this resistance and the distance through which it is overcome measure the work done by the lathe. Stated simply then: Work put into a machine equals friction losses, etc., plus work done by machine. No machine can be made to do work unless a somewhat greater amount of work (sufficient to cover losses) is applied by some outside agent. This applies equally to a simple lever and to a complex mechanism, and, incidentally, to the "perpetual motion" machine.

Strictly speaking, the lever is a simple machine and is also the simplest element of a machine. It consists essentially of a rigid bar, straight or bent, which has one point fixed, about which the rest of the lever can turn. The fixed point is called the fulcrum and the perpendicular distances from the fulcrum to the points where the applied force and resisting force act, are called the arms of the lever. When the lever is straight and the applied force and resisting force act perpendicular to the lever, it is usual to distinguish three classes or orders:



Everyday Examples of the Application of the Principle of Levers of the First Order

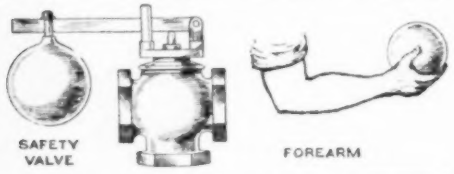
First order. Where the applied force (represented by an arrow) and the resisting force (represented by a weight) act on opposite sides of the fulcrum, as shown in Fig. 1. This order of lever generally gives a mechanical advantage. Its practical use is exemplified by a claw hammer when drawing nails, a pair of simple scales, and the brake of a pump. Double levers of this class are scissors and pliers.

Second order. Where the applied force and resisting force act on the same side of the fulcrum but the former at a greater distance than the latter from the fulcrum, as in Fig. 2. This order always gives a mechanical advantage. Examples of this class are a wheelbarrow, a cork squeezer, a crowbar (with one end in contact with the ground), and an oar (assuming that the blade is in water and at rest); while a double lever of this class is represented by a pair of nut crackers.

Third order. Where the applied force and the resisting force act on the same side of the fulcrum but the former acts at

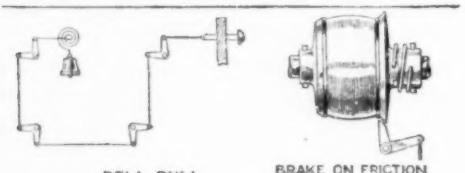
Illustrations Showing How the Second-Order Lever Is Applied to Common Tasks

a smaller distance than the latter from the fulcrum (Fig. 3). In this order of lever there is a mechanical disadvantage. An



Common Examples of Third-Order Levers

example is a steam-boiler safety valve, also the human forearm when supporting a weight in the palm of the hand. In this latter instance the elbow joint is the fulcrum and the tension exerted by the muscles is the applied force. An example of a double lever is a pair of sugar tongs.



Everyday Applications of Angular Levers

It is easy to conceive of conditions where the use of a straight lever in a machine could not be made. For such conditions the angular lever is available. Probably its earliest use was in ringing bells, hence its more popular name "bell crank." The angular lever works under exactly the same principles as the straight lever and is similarly divided into three classes or orders. Having treated of the three orders of straight levers, however, only the first order of angular lever is illustrated here (Fig. 4). The bell crank is usually a right-angled lever, but, as will be observed, any angle may be used.

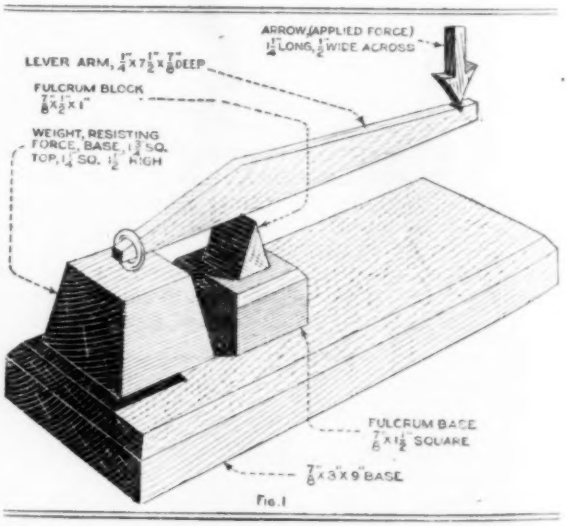
The lever, as well as all the other so-called mechanical powers, is of use to man because: First, they enable him to lift weights or overcome resistances much greater than he could deal with unaided. Second, they may cause a motion imparted to one point to be changed into a more rapid motion at some other point, and third, they enable a force to be applied at a more convenient point or in a more convenient manner. On the other hand, whatever mechanical advantage is obtained by the use of these powers is gained at a proportionate diminution in speed. No work is ever gained by the use of a machine, though mechanical advantage is generally obtained. All of which may be stated in that old saying, "What is gained in power is lost in speed."

The specifications given below are for the construction of stationary or fixed models, but there is no reason why the same parts cannot be made to operate. Furthermore, it is quite feasible to demonstrate the relative advantages of the various types of levers with these models by simply substituting for the wooden weight, representing resisting force, a series of graduated standard weights and using a spring balance attached to the applied force arm to measure the force required to move the various weights. The question as to the amount of power gained by the use of levers will be discussed in the next chapter.

For the model of a simple lever, first order, the materials required are:

Base, 9" x 3" x ⅞".
Fulcrum block, ⅞" x ½", side 1" high.
Fulcrum, base 1½" square x ⅞".
Lever arm, 7½" long, ¼" wide, ⅞" deep at apex.
Weight (resisting force), base 1¼" square, top 1¼" square, side 1¼" high.
Arrow (applied force), 1¼" long, ¼" thick, ½" wide across barbs, ¼" shaft.

Square and face the base and block with a finish bevel on top of each. On the center line of the base and 2¾ in. from its end, secure the block by gluing and bradding from beneath. On the center line of the block, and with its longest dimension par-


ARROW (APPLIED FORCE) 1¼" LONG, ½" WIDE ACROSS
LEVER ARM, ¼" x 7½" x ⅞" DEEP
FULCRUM BLOCK ⅞" x 1½" x 1"
WEIGHT, RESISTING FORCE, BASE, 1¼" SQ. TOP, 1¼" SQ. 1¼" HIGH
FULCRUM BASE ⅞" x 1½" SQUARE
⅞" x 3" x 9" BASE
Fig. 1

Showing How the Model of the First-Order Lever Is Constructed, with Full Dimensions

allel to the center line, secure the fulcrum by gluing and toenailing. The weight is attached to the lever arm by cutting on

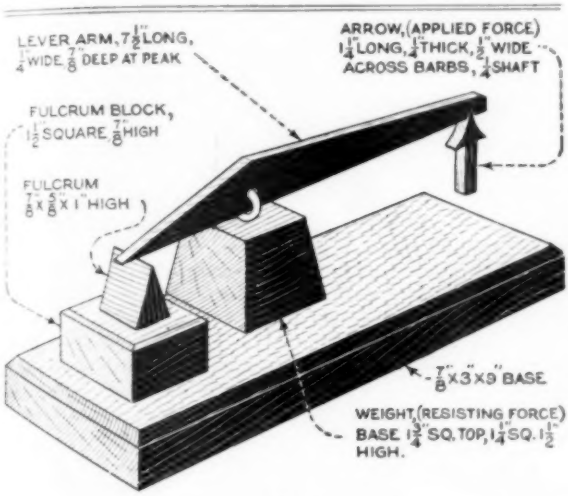

LEVER ARM, 7½" LONG, ¼" WIDE, ⅞" DEEP AT PEAK
ARROW, (APPLIED FORCE) 1¼" LONG, ¼" THICK, ½" WIDE ACROSS BARBS, ¼" SHAFT
FULCRUM BLOCK, 1½" SQUARE, ⅞" HIGH
FULCRUM ⅞" x ⅝" x 1" HIGH
⅞" x 3" x 9" BASE
WEIGHT, (RESISTING FORCE) BASE 1¾" SQ. TOP, 1¼" SQ. 1½" HIGH.

FIG. 2

Details of Model of a Lever of the Second Order, with Sizes of Parts

the shorter end a small notch which will accommodate the screweye used as a handle for the weight. The applied-force arrow is attached closely to the force arm of the lever by inserting it in a small notch. This assembly of lever, force arrow and weight is secured to the fulcrum by the use of an invisible brad as a dowel, inserting the brad into both the peak of the fulcrum and the lower side of the lever arm at a point under the apex, which should be one-third of the distance from the end of the lever. Finish as desired.

For the simple-lever model, second order, the following materials are used:

Base, 9" x 3" x ⅞".
Fulcrum block, 1½" square x ⅞".
Fulcrum, base ⅞" x ⅝", side 1" high.
Lever arm, 7½" long, ¼" wide, ⅞" deep at peak.
Weight (resisting force), base 1¾" square, top 1¼" square, side 1½" high.
Arrow (applied force,) 1¼" long, ¼" thick, ½" wide across barbs, ¼" shaft.

Square and face the base and block with a finish bevel on top of each. On the center line of the base, and ½ in. from the end secure the block by gluing and bradding from beneath. On top of this, glue and toe the fulcrum with its longest dimension running parallel to the center line. The weight is secured to the lever arm by opening a screweye, by which the weight is handled, and running it through a hole bored close to the bottom edge and under the apex of the lever arm. This point of suspension should be one-third of the distance from the fulcrum. The combination of lever arm and weight is secured to the fulcrum and base by invisible brads. The applied-force arrow is inserted in a small notch cut very close to the extremity of the force arm of the lever. Finish as desired.

For the model of the simple lever, third order, use the following material:

Base, 9" x 3" x ⅞".
Fulcrum gallows, consisting of three pieces:
Pillar, 3¾" x ¾" x ¼".
Arm, 1¼" x ⅜" x ¼".
Fulcrum, base ⅞" x ½", side 1" high.
Lever arm, 7½" long, ¼" wide, ⅞" deep at apex.
Weight (resisting force), base 1¾" square, top 1¼" square, side 1½" high.
Arrow (applied force), 1¼" long, ¼" thick, ½" wide across barbs, ¼" shaft.

Square and face the base and finish with a bevel. Equally divided on the center line of the base, and ½ in. from the end, cut a mortise ¾ in. x ¼ in. x ⅜ in., in size. Square and dress the pillar and arm of the gallows and secure the arm on top of the pillar by glue and brads. Secure the fulcrum to the under side of the gal-

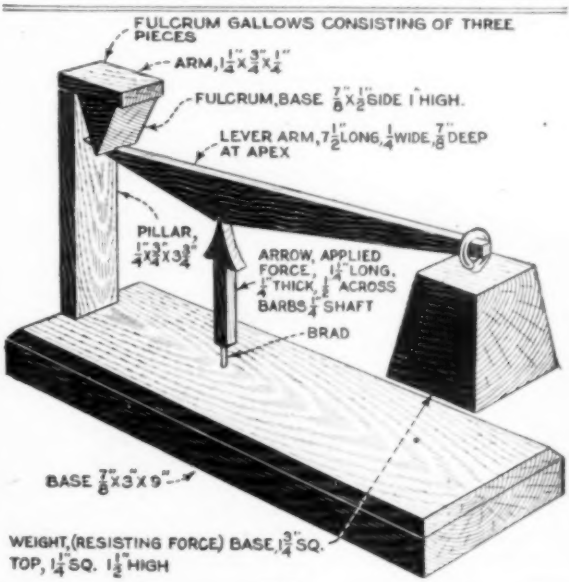

FULCRUM GALLOWS CONSISTING OF THREE PIECES
ARM, 1¼" x ¾" x ¼"
FULCRUM, BASE ⅞" x ½" SIDE 1" HIGH.
LEVER ARM, 7½" LONG, ¼" WIDE, ⅞" DEEP AT APEX
PILLAR, ¼" x ¾" x 3¾"
ARROW, APPLIED FORCE, 1¼" LONG, ¼" THICK, ½" ACROSS BARBS, ¼" SHAFT
BRAD
BASE ⅞" x 3" x 9"
WEIGHT, (RESISTING FORCE) BASE, 1¾" SQ. TOP, 1¼" SQ. 1½" HIGH

FIG. 3

Drawing of Model Illustrating Principle of Third-Order Lever

lows arm by glue and brads. Insert this assembly into the mortise and secure by glue. On the long end of the lever arm fasten the weight by accommodating the screweye, used as a handle, in a small notch cut on the flat edge of the lever arm. Secure the applied-force arrow to the apex of the fulcrum by inserting its point in a notch. This assembly is fastened to the remainder of the model by bradding the toe of the lever arm to the peak of the fulcrum, using a brad as a dowel to support the force-indicating arrow in a vertical direction. Stain, finish, and polish in any manner desired.

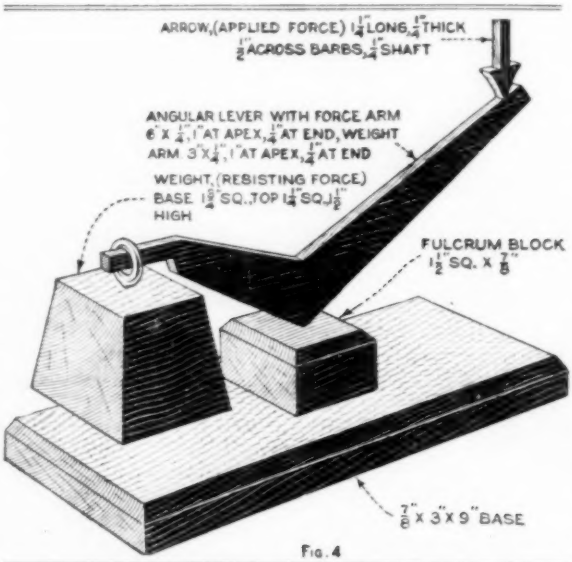

ARROW, (APPLIED FORCE) 1¼" LONG, ¼" THICK
½" ACROSS BARBS, ¼" SHAFT
ANGULAR LEVER WITH FORCE ARM
6" X ⅞", 1" AT APEX, ¼" AT END, WEIGHT
ARM 3" X ¼", 1" AT APEX, ¼" AT END
WEIGHT, (RESISTING FORCE)
BASE 1⅝" SQ., TOP 1¼" SQ., ½"
HIGH
FULCRUM BLOCK
1½" SQ. X ⅞"
⅞" X 3" X 9" BASE

Fig. 4

Model of Angular Lever of the First Order, with Dimensions of All Details

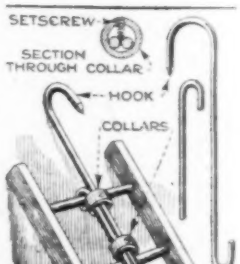
For the angular lever; first order:

Base, 9" x 3" x ⅞".
Fulcrum block, 1½" square by ⅞".
Angular lever:
Force arm, 6" by ¼", 1" at apex, ¼" at end.
Weight arm, 3" x ¼", 1" at apex, ¼" at end.
Weight (resisting force), base 1¼" square, top 1¼" square, side 1½" high.
Arrow (applied force), 1¼" long, ¼" thick, ½" wide across barbs, ¼" shaft.

Square and face the base and block, with finish bevel on top of each. Upon the center line of the base and 4 in. from the end secure the block by gluing and bradding from beneath. The angular lever may be constructed in either of two ways, the simplest being to lay out the dimensions given upon a one-quarter inch board, placing the arms at an included angle of 130°, and sawing out the arm. Another method, which would be more economical in wood, and would obviate the danger from weak grain, would be to build up the angular lever from two pieces, joining them at the apex with a halved-to-gether lapped joint. The weight is attached to the short arm of the angular lever by inserting the screweye, used as a handle, in a small notch and cutting away a portion of the weight arm to allow the weight to swing vertically. The applied-force arrow is secured to the force arm of the lever by inserting the point in a small notch. This assembly is secured to the block by using a brad as a dowel, inserting this into both the apex of the lever and the center of the block. Finish as desired.

Homemade Ladder Hook

A ladder hook, attached to the upper end of a ladder as a means of holding it in place securely, is a measure of safety as well as convenience. One that is simple to make is shown in the illustration. It consists of two ⅝-in. steel rods and two collars. The largest rod is 4 ft. long and is bent at both ends, one end to fit the rungs of the ladder and the other end bent into a semicircle about 6 or 8 in. in diameter and ground to a point. The other rod is 2 ft. long and has one end bent to fit the ladder rungs. The collars are large enough to accommodate both rods, as shown in the cross section. After the rods are slipped into the collars and adjusted on the top rungs of the ladder as shown, the setscrews in the collars are tightened down to hold the rods securely. The hooks must clamp the rungs of the ladder firmly so that they will not slip sideways.



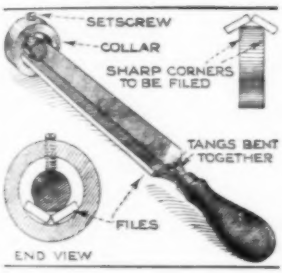
¶When lubricating broaches, direct the stream into the hole at the top.

Oil Can Spreads Stamp Ink

Applying ink to stamp pads by pouring some ink out of the bottle and then spreading it over the surface of the pad with a knife, is a slow and inconvenient task, and in doing this one is very likely to get the hands soiled with the ink, which is extremely difficult to remove. A much better method of applying stamp ink is to use an oil can with a short spout and a fairly large outlet.

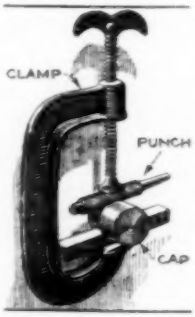
Removing Burrs on Turret-Lathe Work

Half the time ordinarily required for filing off burrs on turret-lathe work can be saved on many jobs by using two files arranged as shown in the accompanying drawing. This method was employed in a shop producing a large quantity of brass collars, the wire edges on both sides being removed in one operation. The files are held in proper position by a collar and a loose piece of rod, slipped through the collar as shown. The tangs of both files are bent inward and driven into an ordinary file handle. By varying the size of the rod and the diameter of the hole, the files can be set to suit different widths of work.



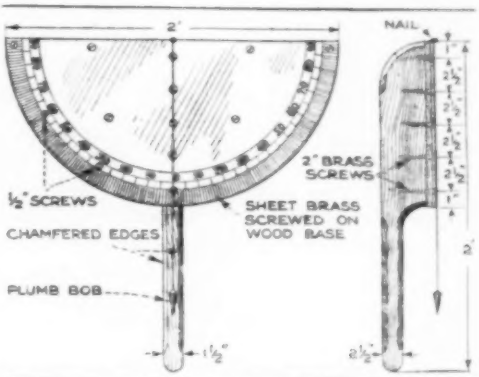
An Emergency Pipe Wrench

When unscrewing a cap from a gas pipe that projects through the wall, it frequently happens that the nipple turns instead of the cap. The nipple is usually so short that a pipe wrench cannot be used to hold it and therefore other means must be employed. Clamp a narrow iron bar and a nail set or punch on the nipple by means of a C-clamp as shown in the illustration, to hold the nipple securely, and the cap can then be unscrewed quite easily, and without any further difficulty.—Edwin M. Love, Alhambra, Calif.



Field Protractor for Vertical Angles

Vertical angles for railroad fills and embankments, altitudes for topography, etc., can easily be determined by using a simple



A Simple Homemade Hand Level Which Will Prove of Assistance to the Amateur Surveyor

protractor of the kind shown in the illustration. It is made from a piece of heavy sheet brass, cut to a semicircular shape having a radius of 1 ft., and graduated into degrees from 0 in the center to 90 at either side. The graduating marks and numerals are etched on, which is done by first covering the brass with a thick film of asphaltum varnish or wax, and, when dry, scratching through it with a sharp scriber. The brass is then etched by applying a solution consisting of 16 parts of nitric acid in 160 parts of water, and 6 parts of potassium chlorate in 100 parts of water, the two solutions being made separately and then mixed together. Whenever an acid and water are mixed the acid must always be poured into the water; never the water into the acid, in order to avoid accidents. Nitric acid also causes severe burns and its fumes are highly poisonous, which makes it necessary to handle it with extreme care.

After the brass is etched to the desired depth, the wax is removed and the plate is screwed firmly to a ½-in. wooden base of the same size and this is screwed to a wooden handle as shown. The handle also serves to prevent the base from warping or splitting. A nail is driven into the upper part of the handle and a plumb bob suspended from it. The wooden parts of the instrument are made of hard, tough wood, such as maple or beech, varnished or oiled.

In use the instrument is held so that the plumb bob will swing freely and when it is at rest the angle can be read by an assistant.—J. J. Brehm, Baltimore, Md.

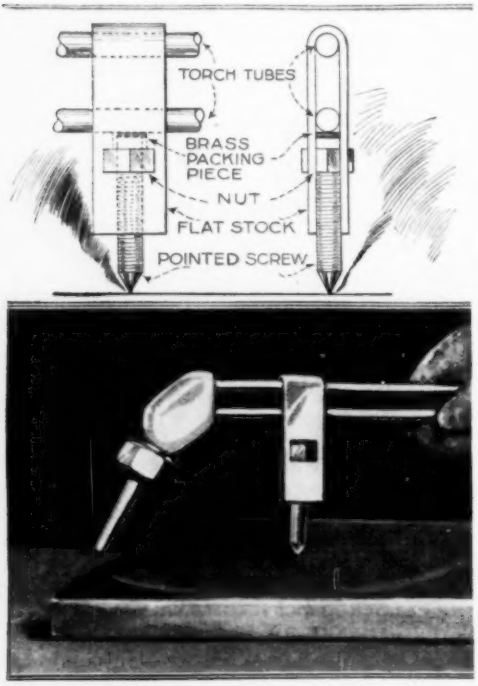
Weeder for Small Crops

Homemade Weeder for the Early Cultivation of Small Crops Such as Soy Beans and Small Corn

A homemade weeder of the kind shown in the photograph has been found to be an excellent tool for the early cultivation of soy beans and small corn. It is made by joining together two weeders, side by side as shown, and hooking them to the frame of an old corn cultivator. With a team of horses hitched to this improvised weeder, and a small boy driving, a surprising acreage of ground can be cultivated in one day. It roots out the small weeds and grass without damage to the crop.

Cutting Circles with Torch

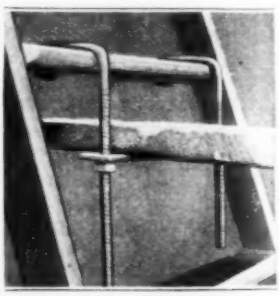
The cutting-torch attachment shown in the photo will be found useful when cutting off the corners of square plates and other similar work where the torch moves in a circular path. A piece of flat plate, bent over to fit the torch tubes, is drilled through the side and squared out for a nut, into which a pointed, headless screw threads. This completes the attachment with the exception of a piece of flat brass, bent over the top of the screw to prevent it from marring the tube. In operation, the work is laid out from a center as usual, and the end of the pointed screw placed on the center before commencing the cut. The attachment is slid along the torch tubes to the required position and locked by turning the screw.



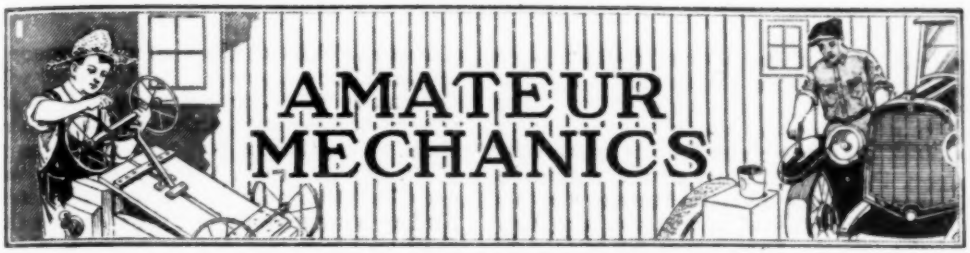
Simple Attachment for a Cutting Torch, Which Is of Great Assistance in Making Circular Cuts

An Adjustable Scaffold

Painters and paperhangers often use a scaffold made by extending a plank between the steps of two stepladders. As the height of ceilings varies, the plank can be raised or lowered one or more steps to suit the worker, but the change of a foot in the height of the scaffold is often too much. For this reason the hooks shown in the photo will be found very convenient, as with their use, the scaffold can be raised or lowered to any desirable height. The hooks are made of ½-in. iron rod, bent as indicated, and threaded for almost their entire length. A 14-in. length of flat steel, ¼ in. thick and 2 in. long, is drilled at each end to fit loosely on the hooks, and nuts are screwed on, as shown, to hold the bar at any point. The hooks are hung on the steps and the plank is placed over the bars. Four hooks and two steel bars form a complete set.



¶A fine feed must be used on milling-machine work that is likely to be easily sprung.



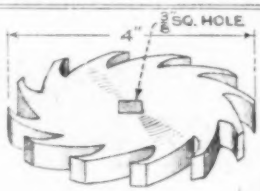
Building a Small Turbine Motor

By B. FRANCIS DASHIELL

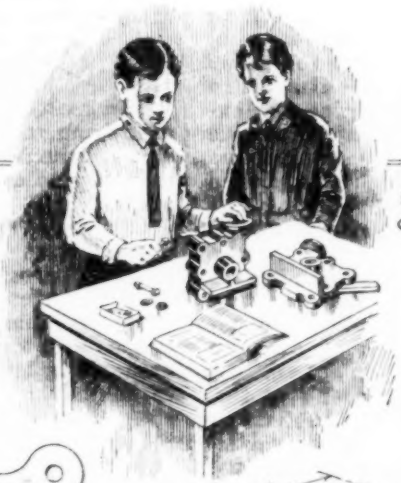
A SMALL turbine motor can be used in a number of ways and the one described in this article will operate on steam, compressed air, or the ordinary house water supply. As a water turbine, its efficiency is very high.

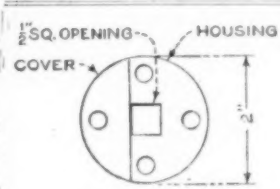
The construction work can be done in the experimental shop, and complete dimensions and plans are given herewith in the accompanying drawings. A pattern should first be made for the housing and cover plate, after which the parts may be cast at a foundry in either iron, brass, or babbitt metal, preferably iron. The entire details of the turbine housing are indicated in the drawing, but the cover plate was not detailed, as it should merely be ¼ in. in thickness and shaped so as to match the housing at all points. A base flange is made on the cover plate, the same as that on the housing, and the remaining portion of the top flange is constructed so that when the cover is screwed to the housing, a complete flange coupling is obtained for the bolting on of an ordinary pipe coupling.

After the casting has been made, it should be smoothed up in the

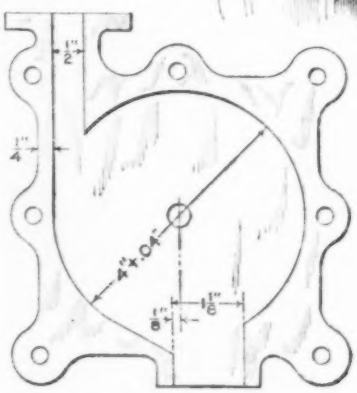


WHEEL

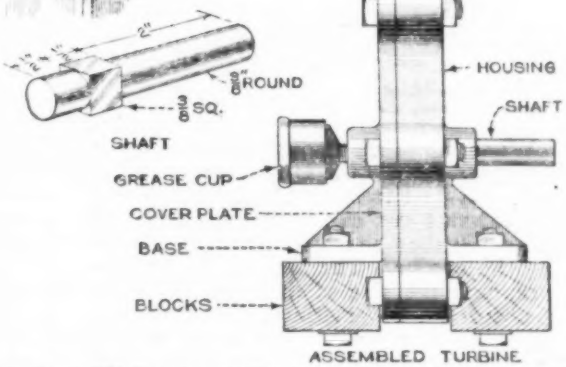




PLAN OF FLANGE JOINT



TURBINE HOUSING



ASSEMBLED TURBINE

Details of Construction of Simple Turbine for Operation on Steam, Water, or Compressed Air, Which Can Be Built in the Small Workshop and Used for a Variety of Purposes

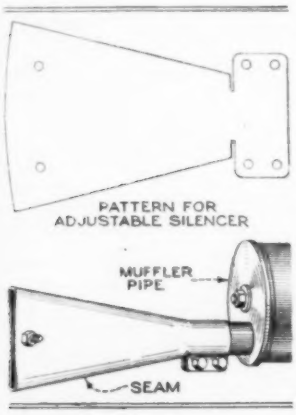
shop. A light cut should be taken in a lathe so as to bring the inside diameter of the wheel housing to the proper size. The face of the housing should be trued up as well as the cover plate. If this is carefully done, the wheel should rotate within its housing, making a perfect running contact with its sides as well as with the periphery of the wheel. Such a perfect sliding fit will add much to the power obtained from the turbine. Drill the shaft hole in the housing, using a ⅜-in. drill. The shaft hole or bearing in the cover plate is not drilled all the way through, but only ½ in. in depth. The rest of this hole is smaller and threaded so as to take a small grease cup, which should be screwed in place. Drill all necessary capscrew holes, and tap those in the housing.

The wheel may be a rough casting which has been turned up to an exact 4 in. in diameter. The two sides should be ground or planed down parallel, so the wheel will be exactly ½ in. in thickness. A ⅜-in. square hole is cut in the center for the shaft. This shaft is made up of a piece of ⅜-in. square stock, turned down at the ends, but still retaining the ⅜-in. diameter. No key is required to hold the wheel on the shaft as it is impossible for either to move after the cover plate has been bolted in place.

The turbine should be bolted down to two heavy pieces of timber to hold it in position and permit free exhaust or drainage for the waste or overflow of steam or water. A support may be so arranged that the turbine can be direct connected to a generator for the production of electricity for charging batteries, etc. A small pulley can be fitted to the shaft and used to operate light machinery.

Additional Silencer for Auto

The illustration shows an additional silencer for the automobile exhaust pipe. It consists of a piece of ⅛-in. sheet iron, cut out as shown and bent to the shape of a cone. The narrow end is clamped to the short section of exhaust pipe that extends from the muffler, and the wide end has two holes drilled through it near the edge, and is fitted with a bolt so that the size of the opening can be varied. Of course, this attachment causes additional back pressure, and it should therefore be used in the city only.



When motoring through the country at a greater speed than is customary in the city, it is best to remove the bolt so that the exhaust gas can escape quickly, and there will then be no danger of overheating the engine. The best method of determining the size of the cone is to use the "cut-and-try" method, with a piece of paper as a pattern. The edge of the sheet-metal cone is joined with a seam, made by bending over the edges about ¼ in. and hammering them down with a light hammer. With the silencer nearly closed, the exhaust causes only a slight whistling sound that can hardly be heard at a distance of 20 or 30 feet.

Rat Poison

The most effective means known for destroying rats is to poison them. Powdered barium carbonate is an inexpensive mineral, and one that is excellent for this purpose.

Other poisons commonly used are phosphorus, arsenic, and strychnine. The use of phosphorus is attended with danger from fire, arsenic is uncertain in its action, while strychnine is readily detected by rats and is too fast in its action to make its use desirable in buildings. Powdered barium carbonate, however, is effective, inexpensive, and relatively safe. It should be thoroughly mixed and worked into soft baits in the proportion of 1 part of the mineral to 4 parts of the selected food. Water is added in sufficient quantity to make the baits moist. Food moistened to the consistency of soft mush is particularly acceptable to rats in dry weather. The barium carbonate should be sifted over sliced baits and rubbed well into them with the fingers or a knife. The slices should be thin and should be moistened if necessary to attain as nearly as possible the 1 to 4 ratio. Soft baits may be mixed with the hands or with a spoon. Barium carbonate has the advantage of being slow in its action so that the rats affected by it have time to leave the premises in search of water or to return to their burrows before they succumb. Baits that are likely to

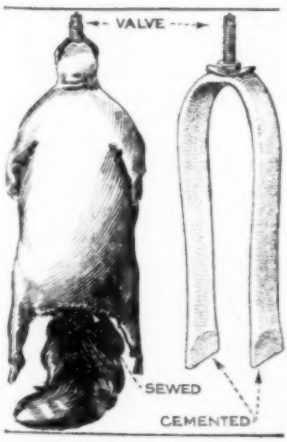
sour under the influence of warmth should be removed daily and fresh bait substituted; if left exposed in warm places for more than a day they will sour and the resulting acid will give them a bitter and highly objectionable taste and odor.

Poison used in chicken inclosures should be put in places that are inaccessible to the chickens, as behind or under boxes, and it should be very wet, or of such a nature that the rats cannot drag it out.

A variety of baits used separately not only gives the rat a choice of foods, but tends to make it less suspicious. One kind of each of the following classes of food mixed with barium carbonate is recommended: Meats such as hamburg steak, sausage, fish, liver, bacon and the like; vegetables and fruits such as thin slices of muskmelon, apple, tomato, or cucumber, canned corn, or squash or pumpkin seed, mashed banana, boiled carrot or baked sweet potato, and cereals. Kitchen scraps and garbage can be worked into the ration to advantage.

Barium carbonate is a relatively mild poison, but the danger from accidents cannot be over-emphasized. It should be kept out of reach of children and irresponsible persons, and from domestic animals and fowls. In case of accident the antidote is an emetic consisting of mustard or salt dissolved in warm water. Vomiting can also be induced by inserting the finger in the back of the throat.

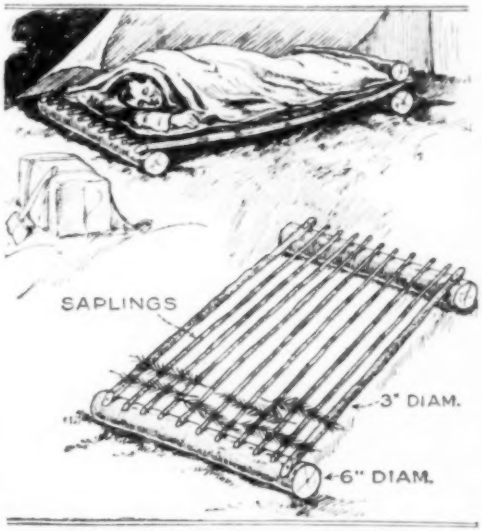
Method of Stretching Green Furs



Old inner tubes can be used to advantage for stretching green furs. The tube is cut off to a suitable length and the ends cemented together as shown in the illustration. It is then put in the fur and after the valve is drawn through the mouth, and the rear part of the fur sewed up, the tube is inflated with an ordinary automobile tire pump. This method will stretch the skin uniformly without distorting or injuring it in any way.—H. H. Siegele, Emporia, Kan.

Improved Bough Bed

To make an exceptionally comfortable bough bed for the camp does not take much more time than is usually consumed



A Comfortable and Healthful Bough Bed for Campers, that Can Be Made as Easily as the Ordinary Type

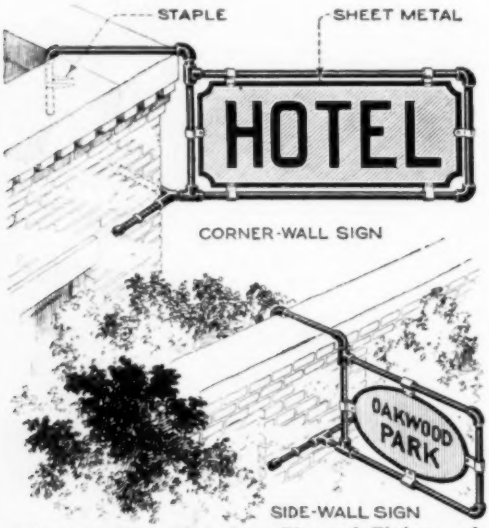
in the building of an ordinary one. Two logs, about 4 ft. long and 6 in. in diameter are used for the end pieces, and to them are nailed several 7-ft. lengths of springy, green saplings of uniform diameter—about 1½ in., these having been trimmed down to free them from offensive projections and spaced about 3 or 4 in. apart. The saplings on the sides should, however, be about 3 in. in diameter. A 4-in. log can be used across the bottom end to hold the blankets down, which will be appreciated considerably on cold nights. A mattress about a foot thick is then made by placing small twigs across the saplings. Due to the air space underneath, a bough bed of this kind is much more healthful than a bed built on the ground.—R. Melrose, St. John, Can.

Preventing Windows from Steaming

Steamed and frosted windows are a source of annoyance to many housewives as the moisture not only obstructs the view but also soils the glass through the accumulation of dust when sweeping or cleaning. A cloth bag containing a few spoonfuls of tobacco, placed in the water used to wash the windows, will overcome this trouble and will also impart a clear, crystal effect that is very pleasing.—G. E. Hendrickson, Argyle, Wis.

Inexpensive Sign Hanger

Substantial and attractive metal signs can readily be made from lengths of pipe and fittings and a piece of sheet metal.



Substantial Signs Made from Pipe and Fittings and Heavy Sheet Metal

The hanger is attached to a building as shown in the illustration; no guy wires or bracing of any kind are required to support it, still it is so solid that the strongest winds will not loosen it. Two different designs are shown; one for mounting the sign at right angles to the sides of a building and the other for mounting it on a corner so that it can be seen from two streets. The sign itself is a piece of heavy sheet metal attached to the pipe frame by means of metal clips, passed around the pipe and riveted to the edge of the sheet metal as shown.

Bucket Reduces Speed of Fishing Boat

According to manufacturers' statistics about 90 per cent of the detachable rowboat motors are purchased by pleasure anglers who go trolling for trout, salmon, or other fresh and salt water game fish. However, the disadvantage of using these motors for this purpose is that they cannot be throttled down to run slowly enough for trolling, without being fitted with a special low-pitch trolling propeller, which the manufacturers provide as an accessory. One man, experiencing this difficulty, tied an ordinary galvanized-iron water pail to the stern of the boat with a 15-ft. rope so that the bucket would serve as a small "sea anchor" and retard the speed of the boat. The resistance of the bucket dragging astern was sufficient to give the boat the exact trolling speed desired when the motor was operated with throttle half open.

A bucket is part of every angler's equipment and its use for this purpose saves the expense of purchasing a special trolling propeller, which entails the constant bother of changing propellers.

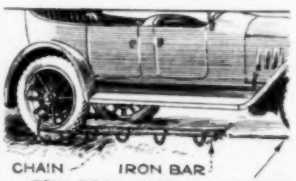
Cleaning White Woolens and Furs

Garments are often dry cleaned at home but the result obtained in the case of white woolens or furs is not always satisfactory. However, the simple trick described below can be employed by anyone, and the results will prove a pleasant surprise.

After the woolen or fur has been washed and rinsed in gasoline, it should be wrung or shaken out thoroughly and placed in a deep pan. A pound or two of white flour should then be sifted over and rubbed into the article. After allowing the article to dry on the line, the flour is whipped out, leaving the garment in a cleaner and whiter condition than usual after cleaning. This is due to the fact that the flour sifts into the fur or fabric and absorbs the dirt with the gasoline that cannot be wrung or shaken out. When whipped out, the dry flour naturally carries the dirt with it.

Pulling Car Out of Mud

When stuck in mud the lone autoist need not despair as long as he has a pair of good chains with him, for, with their help, the car can usually be run out of the mud, providing of course, it is not too deep. One end of a chain is fastened around the tire and to the spokes of a rear wheel, as shown in the drawing, while a short, stout iron bar is pushed through the links at the other end of the chain and a tow rope tied to this bar. If no iron bar is handy or it is too large to be pushed through the links, the tow rope is tied to the last cross chain. The other end of the tow rope is securely tied to a tree located in front of the car, slightly toward the side. By applying power to the wheel, it will run along the chain for a foot or more. The operation is repeated until the wheel is out of the mud.



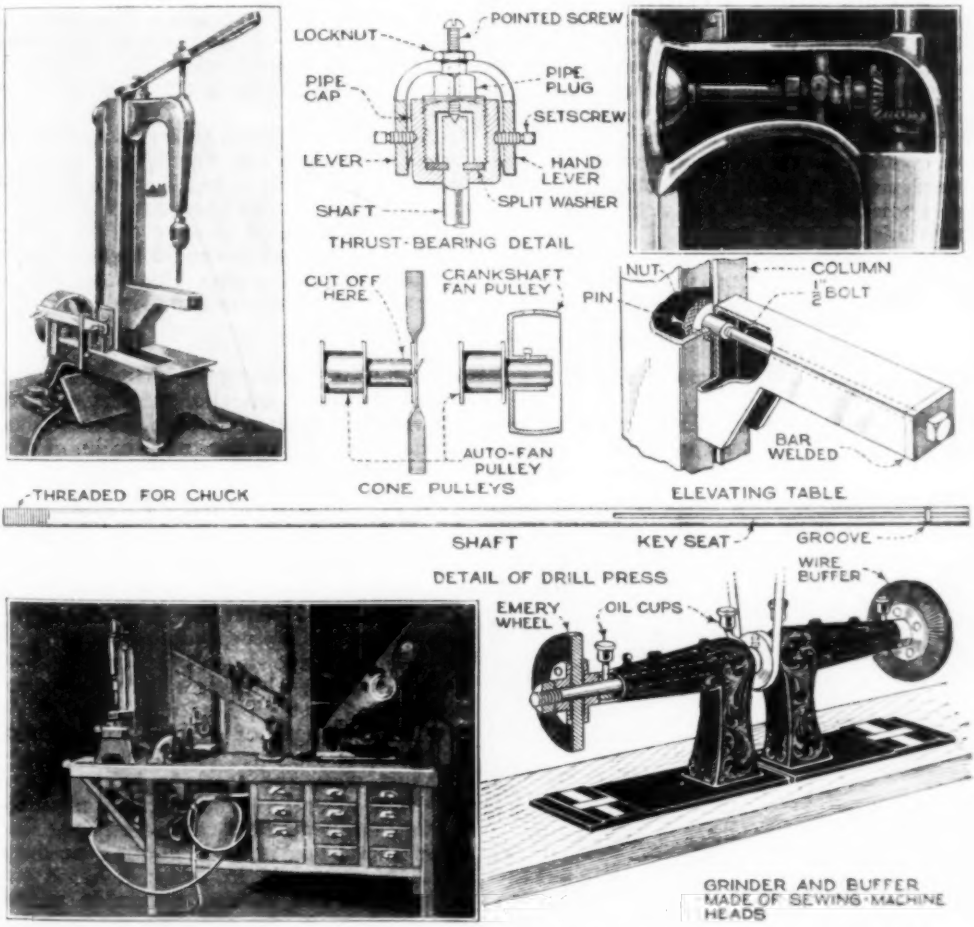
Tools Made from Sewing-Machine Heads

By RUPERT A. ANDERSON

VERY effective small machine tools for the amateur's shop can be made from discarded sewing machines. The drill press shown in the illustration has as its most important feature a sewing-machine head. This was adapted for the job with very little alteration, and saved a great deal of time and work.

The materials needed are: A sewing-machine head complete with spindles and bevel gears in the top; a base, in this case taken from an old cream separator; a set of 6-in. fast and loose pulleys; a set of cone pulleys (made from Ford fan spindles and crankshaft pulleys); shafts of suitable size for head and chuck; small countershaft bearings; a chuck, and a few pieces of auto-frame channel iron and flat bar steel.

The first thing to do after getting the machine head is to decide on the vertical-spindle travel; about 3 in. is suitable for most purposes. The needle-bar end of the head is then sawed off, leaving the bearing flush with the end, and the end of the head dressed off to the shape desired. Both bearings are then reamed to the same size, which should be standard so as to take a cold-rolled steel spindle. The lower end of this spindle is threaded to fit the chuck, which may be a breast-drill chuck, and which may have to be fitted to a sleeve, which, in turn, is fitted to the spindle. The other end is grooved to take a small split washer, used as a thrust bearing. This groove is cut a little farther above the head than the travel of the spindle.



Upper Left, Finished Drill Press; Upper Right, Gearing in Head; Center, Details of Construction; Lower Left, Bench, with Drill in Place; Lower Right, Grinder and Buffer

The thrust bearing holds the spindle up when running idle and pushes it down when drilling. It may be made from a pipe cap and plug as shown in the detail; the plug is drilled to clear the spindle at one end, and for a pointed setscrew at the other. The screw bears against the center in the end of the spindle, and the plug locks the split washer to the shaft and pipe cap. The hand lever is pivoted to the cap by two pointed screws, bearing in drill spots.

The bevel gear is keyed to the shaft, the key being a sliding fit in the gear, and somewhat longer than the required travel. The gear is kept meshed with its mate by a plate fastened to the head under it. The horizontal shaft is now put in, and the head packed in grease.

Two pieces of the channel iron are cut to the desired height and bolted together, webs out, with spacers on the bolts so as to leave ½ in. of space between the edges of the flanges. The standard thus made is mounted perpendicularly on the base, by means of small angle plates, and the head screwed to the upper end, using the same screws as used on the sewing machine. The head must be mounted absolutely square, as upon this depends the accuracy of the machine.

The method of making the cone pulleys is clearly shown, and demands no explanation. The countershaft may be fitted wherever desired, but is neater if mounted on the base. If this is done, the fast and loose pulleys should overhang, so that the belt can be run downward, if desired. A spring is attached to the rear end of the flat-steel hand lever to keep it raised when not in use.

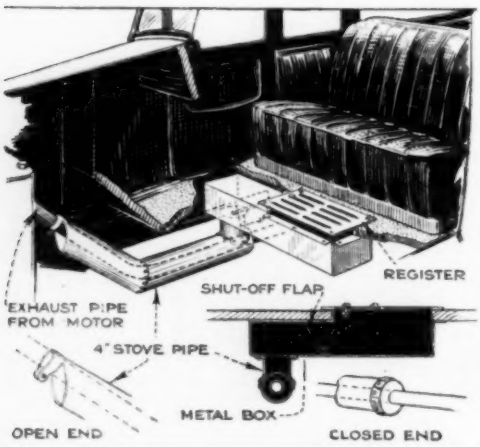
The illustration at the lower right shows in detail the elevating table, which also must be exactly square with the standard. This may be altered so as to allow it to swing to the sides, which would allow work to be drilled that otherwise could not be handled.

In making the grinder and buffer shown in the lower illustration, two sewing-machine heads of the same height are selected. The needle-bar ends are cut off as before, the ends dressed off smooth, and the bearings reamed to standard size. The heads are then mounted on a base, and are held in line by the spindle. The spindle is threaded right and left hand, and provided with nuts and washers to fit. The inner washer at each end is threaded to screw on the spindle.

A small V-grooved pulley is made to fit closely between the heads, and fastened with a headless setscrew. If a hole is drilled in the shaft to take the end of the screw there will be little danger of the pulley slipping. The pulley should be fitted so as to prevent end play. Providing oil or grease cups completes the grinder.

Homemade Auto Heater

The comfort of winter auto riding can be greatly increased by installing a heater of the type shown in the drawing. It consists of a length of 4-in. stovepipe, which is hung on the exhaust pipe as shown, and connected with a sheet-metal box, fastened to the underside of the floor. A hole is cut in the top of the box, and in the floor, to allow the heated air to enter the car. There is no danger of getting any exhaust gas or foul air into the car, as fresh air, rushing through the radiator enters the open end of the stovepipe, and after being warmed by the hot exhaust pipe, enters the car.



A Homemade Heater Adds Considerable Comfort to Auto Driving During the Cold Winter Months

The stovepipe is cut at one end to form a clamp, which is securely attached to the exhaust pipe with a small stove bolt. The length of stovepipe consists of sections, to conform to the shape of the exhaust pipe, the sections being riveted together securely. The rear end is closed so that the heated air cannot escape. The sheet-metal box is made about 2 in. deep, 6 in. wide, and 16 in. long; it has a circular hole cut in the underside at the point where it is connected to the stovepipe and a rectangular hole on top about 5 by 9 in., so that a 5 by 9-in. register can be fitted over it. A number of holes

drilled in the floor, would serve the purpose of a register, but would not present such a neat appearance. A shut-off flap is provided inside of the box, so that the heat can be shut off if desired. The flap is made of sheet iron, fitting loosely in the box as shown, and operated by a screw sliding in a slot in the register, the screw being connected to the flap with a length of stiff wire.

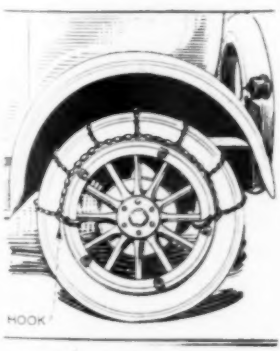
Drawing on Glass

Writing or drawing on glass is not very easy as the ink will not take well unless the surface has been sized. A good size for this purpose can be made by adding 3 or 4 drops of good glue to an ounce of water, and stirring or shaking the water until the glue is well dissolved. The size should be used at once as it will not keep very long, due to the evaporation of the water.

Before applying the size, the glass must be cleaned well. A few drops of the size are then poured on, spread over the surface evenly by turning and tilting the glass, and the glass is then set on a level surface to allow the size to dry. When thoroughly dry, the coated side is ready to be written or drawn upon.

Effective Mud Chain

When the rear wheel of an automobile is sunk in mud nearly up to the hub, it is impossible to get the chain on around the tire, and the motorist then has quite a job trying to get out. In such cases a chain that fits over half of the tire has been found to be of considerable assistance. An old chain is used for the purpose; it is cut in two and one half is slipped over the upper part of the tire as shown. Two 4-in. lengths of chain, having the hooks attached, are cut from the other half of the chain, and used to fasten the ends of the half chain on the wheel. A piece of cloth or leather wrapped around the short chains will keep them from scarring the wheel.—Grover Brinkman, Okawville, Ill.



Jogging Wall for Bookcase

In order that the bookcase in the living room should be flush with the inside surface of the wall, a Nebraska home builder

Jogging a Wall Makes the Bookcase Flush with Interior Surface. Left, View of Outside of Wall

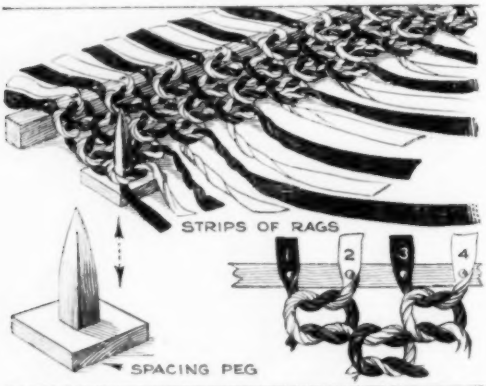
jogged the wall of a bungalow in the manner shown in the illustration, which provided places for potted shrubs outside, and added a touch of distinction and beauty to the architecture of the house. The upper detail shows the plan of this arrangement. A multiple-sash window was provided over the bookcase and this added considerably to the appearance of the room, besides providing more light.—Dale R. Van Horn, Walton, Neb.

Safety Flash-Powder Container

Because of the accidents occurring from the explosion of photographer's flash powder, the safety flash-powder container shown in the illustration was devised. This container does not guarantee against explosion but reduces its force to a minimum. It consists of a length of brass tubing with a cork inserted in each end. Should the powder explode, it will blow the two end corks out of the tube, which is better than having particles of glass fly in all directions, as happens when a bottle "blows up."—H. A. Palmer, Toledo, Ohio.

Simple Method of Making Rag Mats

Excellent doormats can be made at home from strips of rag or burlap. The strips must all be of the same width and twisted until they are about the thickness of a finger. The strips are tacked, about 4 in. from one end, to a length of



Simple Method of Making Rag Mats: Strips of Rag are Twisted and Then Woven Together with Square Knots of Uniform Size

wood, and are spaced ¾ in. apart. The width of the mat depends on the number of strips used, which must be an even number.

After fastening the length of wood to a table or bench, the strips are ready to be woven, which is done by tying them together with "square" knots until the mat is completed. The first knot is tied with the first and second strips, the second knot with the third and fourth strips, the third knot with the fifth and sixth strips, and so on to the end. The second row of knots is begun by tying the second and third strips, then the fourth and fifth strips, and so on. The knots are all tied in the same way, and the method of doing this is plainly shown in the detail. A spacing peg must be used, so that all the knots will be of the same size; the knot is tied around the peg, which is then slipped out. The peg should be about 1 in. square and tapered to a point.

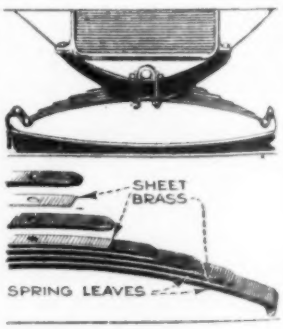
Increasing Effectiveness of Weedless Propeller

There are numerous weedless boat propellers on the market but the majority of motorboat owners who have attempted to drive their boats through heavy kelp, sedge grass, or other aquatic vegetation will testify that the average weedless boat propeller is usually about as weedless as a nonskid tire is actually nonskidding on a wet asphalt pavement.

The writer recently visited the Los Todos Santos Islands off the west coast of Mexico in a motor boat. In order to get to these islands it was necessary to drive the boat through vast kelp beds that were so thick that the boat, even though equipped with a so-called weedless propeller, could scarcely move more than a few hundred yards without the screw becoming fouled by the kelp, making it necessary for a member of the party to go overboard and disentangle the weeds. However, the trouble was finally eliminated by removing the propeller and sharpening the edges. As the propeller was made of bronze the job was easily accomplished by means of a file. After being sharpened, the propeller cut through every bit of seaweed it came in contact with, and no more trouble was experienced. The weed-cutting ability of the sharpened blades is aided by their shape, which gives them a cutting motion similar to a barber's stroke in shaving.—J. E. Hoag, Los Angeles, Calif.

Brass Strips Improve Spring Action

Automobile springs soon become rusty, and this causes so much friction between adjacent leaves that they do not work properly, unless proper attention is paid to lubrication. Their action can be improved considerably by inserting brass strips between them, as shown in the drawing. These strips have smooth surfaces and will not rust, enabling one leaf to slide over another with the least friction, and offsetting lack of lubrication. The strips are cut from 1/16-in. sheet brass, to a length and width corresponding to that of the spring leaves. A hole is, of course, drilled through the strips for the center bolt of the spring, and they are then assembled with the leaves as shown in the lower detail.

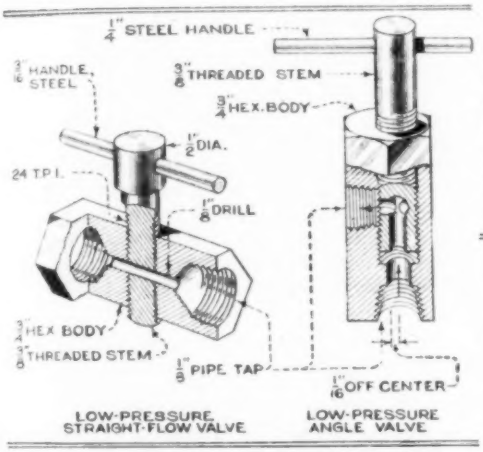


¶To insure prompt reply and safe receipt, when writing to the Bureau of Information, please write name and address plainly.

Easily Made Small Valves

MANY of the mechanisms made in the experimental shop require valves. On experimental machinery, ⅛ and ¼-in. valves are usually large enough, but even these are rather expensive, and, as described in this article, simple and effective valves can quite easily be made, either for high or low-pressure use.

The simplest form of valve is the straight-flow type made by cutting a piece of brass or steel hexagon stock, 2 in. long, drilling a hole in the center, and tapping it ⅜ in.—



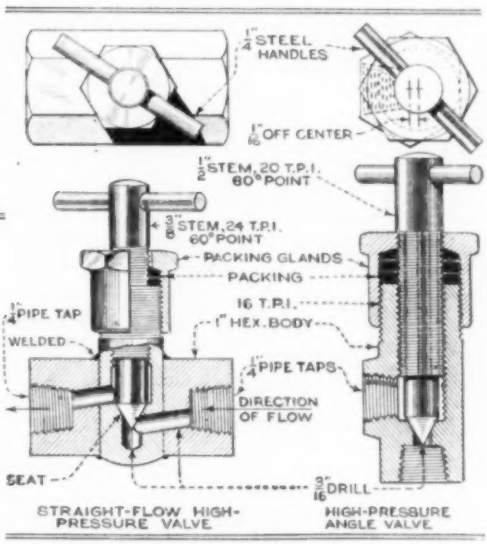
Low-Pressure Straight-Flow and Angle Valves Made from Stock Material

24 threads. Make a stem of the same material and thread it so that it will fit snugly into the body. Fit the stem with a 3/16-in. handle, and screw it into the body until it projects a few threads on the bottom, with the handle parallel to the body. Drill a ⅛-in. hole axially through body and stem, enlarging the ends so as to allow them to be tapped for ⅛-in. pipe. When the handle is turned at right angles to the body, the flow will be stopped. This valve is quite satisfactory for low pressures, if made accurately, and is very simple to make.

The low-pressure angle valve is also made from a 2-in. length of ¾-in. hexagon stock. In this case the ⅜-in. tapped hole is drilled lengthwise, not quite through, and 1/16 in. off center. Fit the stem tightly as before, and drill a ⅛-in. hole through its center from the bottom of the body. This hole breaks into another drilled through the side, as shown, and both holes are enlarged and tapped as before. The stem of this valve has a handle that projects more on one side than the other, and the handle points in the same direction as the side opening or port, thus acting as a guide in using the valve. A half turn opens or closes the valve.

For high-pressure work on gas, liquid, or steam lines, a valve must be used that will not only stand the pressure safely, but will seat tightly when closed. Many mechanics would throw up their hands if asked to make a straight-flow valve for high pressure out of stock material, but it can easily be done. The features mentioned above are incorporated by using heavy hexagon stock for the bodies, and tapered valve seats and stems.

For the straight-flow valve, a piece of 1-in. stock, 2 in. long, is used, and into a hole bored through its center is forced a vertical seat-and-stem piece. The upper and lower ends of the hole must be countersunk, and, after the vertical member is in place, the joints are welded or brazed. This piece is drilled along its axis, and



Stronger Valves, Made for High Pressure, from Similar Materials

tapped ½ in.—20 threads, or ⅜ in.—24 threads, for the stem. The bottom of the hole is machined to a 60° taper, and a 3/16-in. hole is drilled for a short distance below the seat, to provide clearance for the point of the stem. The outside of the vertical member is threaded, and a packing-gland nut made and fitted, using two pieces of ⅛-in. packing. The valve stem is made of steel, threaded, tapered to a 60° point, and fitted with a ¼-in. handle. After the valve has been assembled, the ¼-in. pipe-tap holes are drilled, and then the 3/16-in. passages. The latter holes must

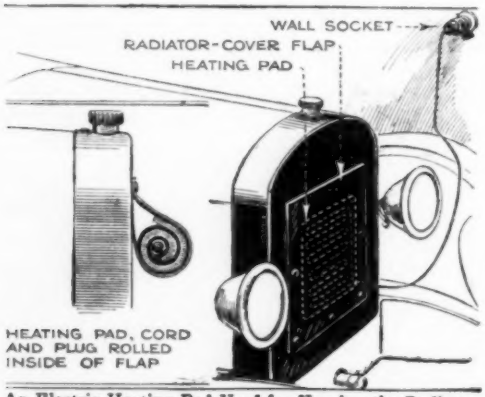
be drilled at an angle, as shown, to avoid drilling into the valve seat.

The angular type of high-pressure valve is of simpler construction. The body is also of 1-inch stock, with the center holes and the turned and threaded parts 3/32 off center. This leaves a thick wall for the side outlet, which is threaded for ¼-in. pipe. The ½-in. stem is fitted and packed in the same manner as the straight-flow stem.

These valves will stand up to 300 lb. pressure, are easy to take apart for repairs or cleaning, and are quite safe for either gases or liquid.

Electric Heating Pad Keeps Engine Warm

An electric heating pad, of the kind used for household purposes, can be used to advantage for keeping the automobile engine



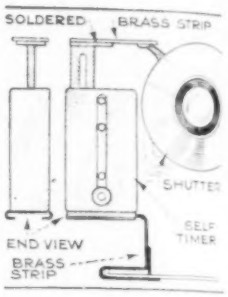
An Electric Heating Pad Used for Keeping the Radiator Warm during Cold Weather

warm during cold nights. It is simply connected to the garage lighting circuit, and sewed on or otherwise fastened inside of the flap of the radiator cover so that it can be rolled up as shown in the left-hand detail. At night it is unrolled, and the plug on the extension cord screwed into the garage lighting socket. The heating pad hanging against the radiator keeps the water warm and causes it to circulate slowly through the engine. This prevents the oil from "gumming," and consequent running down of the battery in an effort to turn the stiff engine.

¶ Sharpening indelible pencils near gray cloth, and allowing the dust to settle on the pieces, has been found to damage this material in cotton mills. The "lead" makes a deep stain which shows when the goods, about to be dyed or bleached, are passed through a moistening process.

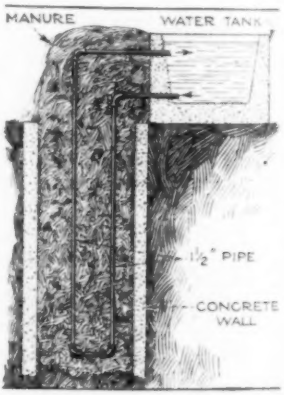
Shutter Release for Self-Timer

Unable to find a self-timer for use on cameras with a lever-shutter release, an attachment was made to hold a self-timer of the ordinary kind, and used successfully. The attachment consisted of a strip of sheet brass, bent so that it fitted tightly on the bed of the camera, and a smaller piece, soldered to the bottom of the timer and with the edges bent so as to slide over the end of the clamp. Another small piece of brass was soldered to the top of the plunger rack so as to rest on the shutter-release lever. In use, the timer was mounted as shown in the drawing, and operated in the usual way.—J. S. Opferman, Pittsburgh, Pa.



Preventing Water Tank from Freezing

Usually the stock-watering tanks on the farm freeze up very easily, unless the water is kept in constant motion. A method that was found very effective in preventing this is shown in the drawing. A 12-ft. pit, about 2 ft. in diameter, was dug next to the water tank and was walled up with broken stone and bricks; concrete can, of course, be used if desired. A pipe line consisting of 1½-in. pipe and elbows, was arranged as shown, both ends terminating in the tank at the top and bottom, and the pit was then filled with fresh manure. The cold water in the tank naturally runs down the pipe leading to the bottom of the tank, while the water already in the pipe rises in temperature, due to the heat given off by the manure, and flows out of the other end of the pipe, causing a slow but continual circulation which keeps the water in the tank from freezing.



Finger Grips for Gloves

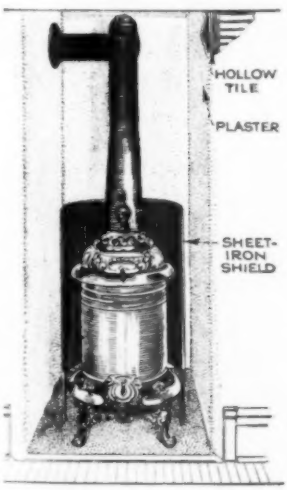
When working outdoors during cold weather when it is necessary to wear gloves, it is rather troublesome to remove them in order to pick up small objects such as screws or nuts. This difficulty can easily be overcome by placing a small coin such as a dime or a penny inside of the glove, in the tips of the thumb and index finger, thus providing two flat surfaces between which a small object can readily be pinched or picked up.—Charles I. Reid, New York City.

Using Old Collars

Old linen collars make excellent tags for packages that are sent by parcel post or express. These tags take ink well and are strong enough to remain attached for the longest journeys. A hole is punched through the tag, near one corner, and a length of stout cord is used to tie it to the parcel. About 6 or 8 tags can be cut from one collar.—Mabel Chase Rundlett, North Adams, Mass.

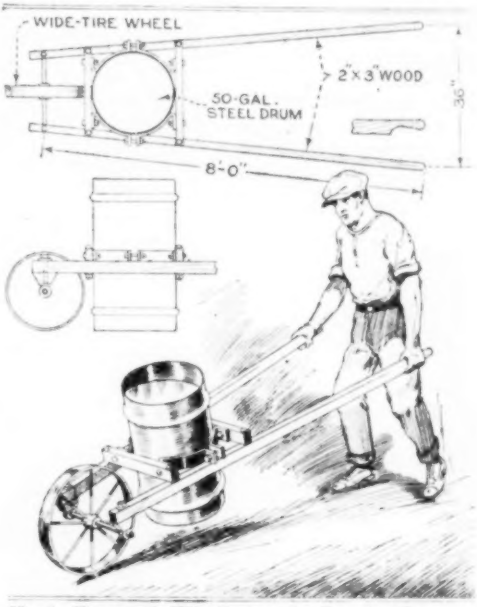
Making the Heating Stove Inconspicuous

Because our grate was found insufficient for heating the house in a semi-tropical climate, it became necessary to put a small stove in the dining room, but this crowded the room, which was small, and also detracted considerably from its appearance. The illustration shows how the trouble was overcome. An opening was cut from the dining room into the pantry just back of the chimney, and a space just large enough for the stove was lined on three sides with hollow tile, to protect against fire; the surface was then plastered. The tile wall was found to keep the heat in well and this effected quite a saving of fuel. A sheet-iron shield was provided behind the stove to protect the plaster from excessive heat.—Jack Spottswood, Jacksonville, Fla.



Wheelbarrow for Concrete

Carrying concrete, sand, and water, or "slops" is greatly facilitated by using a wheelbarrow of the type shown in the drawing. A wheel from an ordinary wheelbarrow, or from an old discarded farm implement is used. The frame is made of 2 by 3-in. hardwood about 8 ft. long, and built as shown. The handles are set about 3 ft. apart so that the barrow can be easily balanced. Two cross pieces of the same material are bolted to the handles and are spaced to accommodate a 50-gal. steel drum as shown, metal straps being provided to hold the drum in place tightly. The drum can be set solidly on the ground.



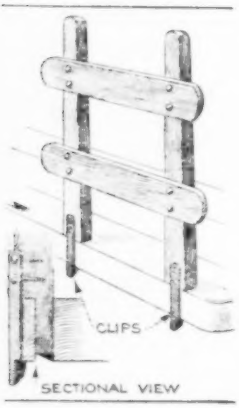
Handy Homemade Wheelbarrow for Carrying Concrete, Water, Sand, and Similar Materials

Renewing Golf Balls

A cheap and practical method of renewing old golf balls is to fill the cracks with white rubber cement, which can be obtained at any drug store. After filling the cracks, the entire surface of the ball is painted. By repairing the balls in this way there are no bumps or cracks, which have a tendency to influence the course of the ball, and the whitened surface will show up well. It is a good idea to wash the balls in cool soapy water before going to the grounds as this helps to retain the old luster and removes stains.—Fred A. Loper, Adams, Neb.

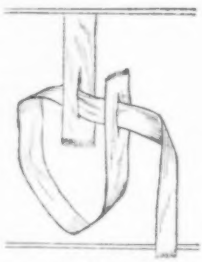
Clips Prevent Loss of Truck Stakes

As soon as the stakes used on motor-truck bodies become worn at the lower ends, it is almost impossible to keep them in place when the truck is empty and bounces over rough roads or streets; they are consequently often lost. This trouble can be successfully eliminated by the provision of clips of the type shown in the illustration. Each clip is made from a piece of ⅛-in. strap iron about 8 in. long and 1 in. wide. Two screw holes are drilled through it as indicated, so that it can be attached to the stake with wood screws. The other end is cut and bent to form a latch that catches under the truck floor or side, and holds the stake in place securely.



Fastening Rag Strips

Rag strips used for making rugs are usually sewed together, but a much better method is shown in the illustration. A slit is cut in the ends of the strips to be connected and the other end of one strip is passed through both slits, as shown, so that when pulled tight, a smooth union is made that is not lumpy. A considerable saving of time is effected by this method.

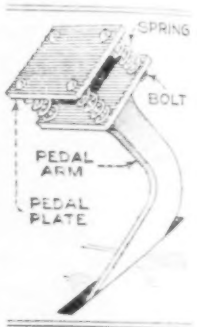


Cork Casters

For medium and light-weight furniture, common corks of large size have been found very serviceable as casters, and in many respects superior to ordinary roller casters or polished metal "domes." Because of their resiliency they yield somewhat, causing the piece of furniture to stand level and solid, and, being soft, they cannot scratch or mar the most highly polished floors but instead gradually wear away themselves. To fit them to the furniture, a hole is drilled in the bottom of each leg for a cork, the hole being, of course, equal to the center diameter of the cork and a little more than half as deep.—Glen McWilliams, Detroit, Mich.

Cure for Grabbing Clutch

To overcome the grabbing tendency of a clutch on a light car, a driver installed an additional pedal plate, attached to the regular pedal by means of four bolts and coil springs, the bolts fitting loosely in holes drilled for them and the springs keeping the plates separated. The bolts used are ¼ in. in diameter and 2½ in. long. They are slipped through holes drilled in the lower plate and reamed out so that the bolts can slip in and out easily when the pedal is under pressure. The auxiliary plate, being the same shape and size as the regular plate, is drilled and tapped to receive the screw ends of the bolts. Before assembling, 2-in. open coil springs, made of No. 10 brass wire, are placed over the bolts, which are then screwed into the threaded holes in the auxiliary plate until they project just a trifle; the ends are then hammered over to keep the bolt from unscrewing. Pressure applied on the pedal causes the clutch to take hold gradually, and all grabbing is eliminated.



Protecting Soldering-Iron Handle

Everyone who uses a soldering iron has experienced the annoyance of having the handle burned off. This is not always an actual burning of the wood but often a charring, caused by the stem of the iron becoming hot. A simple method of overcoming this is to drill out the handle to about twice the size of the iron stem and fill it with molten lead, which will stick firmly to the sides of the hole, and, while the metal is still hot, seat the stem in it. This metal will never become hot enough to char the wood and besides forming a durable handle also balances the iron.

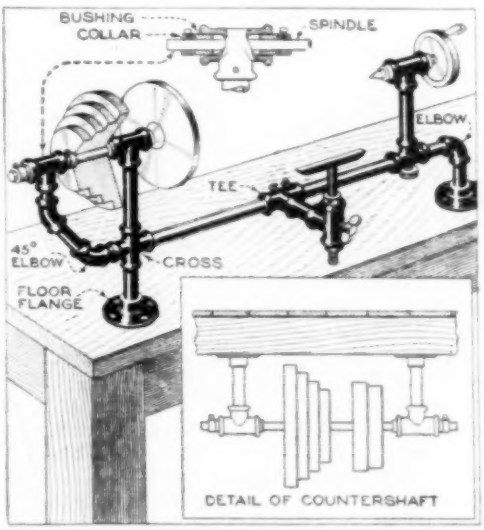
A Bench Lathe of Simple Design

By RODGER L. SIMONS

EVERY budding mechanic craves a lathe on which to develop his ideas, and the one shown in the drawing is not only easily built, but is strong and substantial, and meets the simple needs of the amateur. The only tools needed for making this lathe are those found in the small shop, plus a set of pipe-threading dies; in the absence of the latter any pipe fitter or plumber can do the necessary threading. The machine is assembled as in the drawing. The joints should be screwed up tightly, and white lead should be smeared on the threads before assembling, to make the parts go together more easily and hold them together securely. If the builder has a small taper reamer, it would be well to drill a hole through each joint, ream it out, and drive in a taper pin.

For a lathe with a bed about 2 ft. long, 1-in. pipe, with fittings to correspond, is a good size to use. When assembling the headstock, care should be taken to see that the two tees through which the spindle runs are exactly in line. A 1-in. bushing is screwed into the ends of each tee and the inside threads are drilled out to make a smooth bearing surface for the spindle, or, if any difficulty is encountered in alining the spindle, it can be blocked in position and the tees filled with babbitt. The spindle should be driven out before the babbitt cools, and the bearings reamed to a nice running fit. The spindle is a piece of ¾-in. pipe or rod, turned and polished to a true and smooth bearing surface. If one has a friend who is fortunate enough to possess a lathe, this smoothing and polishing can be done very easily. A thread is cut on one end, onto which a ¾-in. floor flange is screwed as a faceplate. A disk of wood can be used as a pulley until the machine is completed, when a regular wooden cone pulley may be turned, sanded, and fastened to the spindle. A collar should be made from a small piece of round-steel stock and fastened with a setscrew to the outer end of the spindle. The bed is made from a piece of 1⅛-in. cold-rolled steel, threaded on each end for 1-in. pipe, and with a deep, narrow keyway along its whole length, on the upper side.

Holes are drilled in the tailstock and tool rest, tapped, and machine screws, with the ends turned to fit in the keyway, inserted. The screws slide in the keyway and hold the two movable members in line. The tool rest is built up from two 1-in. tees connected by a short nipple and with the long parts, or run, of each at right angles to the other. One tee slides on the bed and the other projects toward the operator; the upper end of the latter is provided with a 1-in. bushing in which the threads have been drilled out. The rest itself is a simple forging that can be made by a blacksmith; the shank is threaded for ½-in. pipe, and a ½ by ¾-in. bushing, with the external threads filed off, is screwed on and the two placed in the tee. A thumbscrew should be provided to tighten the rest at any height, and to prevent it from turning. The tailstock is made by screwing a ¾ by 1-in. bushing into the short end of a 1-in. tee, a long ¾-in. nipple in the bushing, and a ¾-in. tee on the end of the nipple. The runs of the tees should be parallel. A ½ by ¾-in. bushing, the internal threads of which are drilled out smooth, is screwed into each end of the upper tee. A piece of steel bar, of the same diameter as ½-in. pipe, is threaded on one end, and a center point ground on the other to serve as a tailstock spindle; a handwheel is fastened on the threaded end with locknuts. Thumbscrews should be provided to tighten the tailstock to the bed, and the spindle to the tee. In both the tool rest and tailstock the tees that



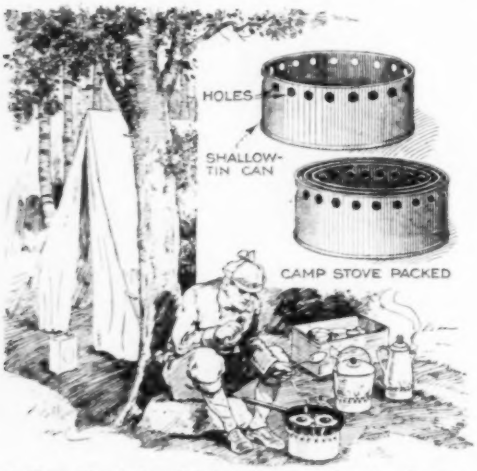
Simple Lathe for the Amateur, Made Almost Entirely of Pipe and Fittings

slide on the bed must have their threads filed off to allow them to slide freely. The standard supporting the tailstock end of the lathe is built by screwing a 1-in. elbow on the threaded end of the bed, a 1-in. bushing into the open end of the elbow, a long ¾-in. nipple into the bushing, and a ¾-in. flange onto the nipple, as in the drawing.

A countershaft is easily made; a long 1-in. nipple is screwed into a 1-in. flange, a tee is screwed onto the nipple, and a 1-in. bushing screwed into each end of the tee. The inside threads of the bushings should be drilled out smoothly to form the shaft bearing. Two such assemblies are mounted on the floor or ceiling in such a manner that the openings in the bushings are in exact alinement. A steel shaft, of the same size as the drill with which the bushings are drilled, is fitted with a cone pulley of the same size and proportions as the one on the lathe, and with tight and loose pulleys for starting and stopping the machine, and a simple belt shipper is provided.

A Simple Camp Stove

Finding that a mixture of earth and gasoline would burn with a fine hot flame, even if the earth were wet, an ingenious camper devised the simple portable camp



A Very Simple but Efficient Form of Gasoline Camp or Touring Stove

stove shown in the drawing. It consists of a wide, shallow tin can having a row of holes punched through the side along the upper edge. The can is about half filled with earth, then about ¼ pt. of gasoline is poured over the earth and thoroughly mixed with it. Upon lighting this mixture, it burns with an intense heat for about fifteen minutes, which is ample time for preparing coffee. Three tin cans, one a little smaller than the other so that they can be telescoped into each other to save space when carrying, have been found very convenient on camping trips.—J. B. Smoller, Atlantic, Iowa.

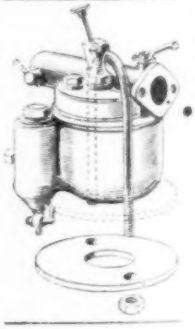
¶ To restore the color of a shellac surface that has become white in spots, hold a heated iron over the spots.

Removing Water from Mortar

When mixing concrete it often occurs that too much water is added, making the mixture too thin to work properly. Of course, more sand and cement can be added, but this is not always desirable, as it increases the quantity of concrete, and this may not be necessary. A good method of removing the excess of water is to place a few common bricks in the mixture for a few minutes, and it will be found that the bricks absorb so much of the water that the mixture soon becomes workable. A common brick, when thoroughly dry, will absorb about a pint of water.—R. Rittenhouse, Rockingham, North Carolina.

Repair for Carburetor Bowl

The nut holding the bowl of a Ford automobile carburetor in place has a tendency to loosen due to the continual vibration, and the loose bowl then allows a considerable quantity of gasoline to be wasted. The frequent tightening of the nut soon strips the fine thread on the brass overflow pipe on which it screws, making a new part necessary. However, on carburetors of this type, the simple repair shown in the drawing can easily be made and will not interfere with the moving parts. This repair will hold the bowl in position securely and the nuts will not need to be tightened more than once, as lock washers are provided to keep them tight. The U-bolt is passed over the body of the carburetor and a steel disk, drilled to fit the legs of the bolt and the end of the overflow pipe, is fastened on with nuts.



Using Auto Battery for Camp Lighting

An automobile-lighting battery will furnish a convenient source of current for a few lights around a camp or small country house, especially during the summer, when the car is used a great deal, and it is sometimes necessary to use the excess current by burning the lights during the day. One way to obtain the current for the purpose mentioned is to plug in to the dashlight and connect to the lighting circuit, but this means that all the lights must be switched on when the outside lights are used.

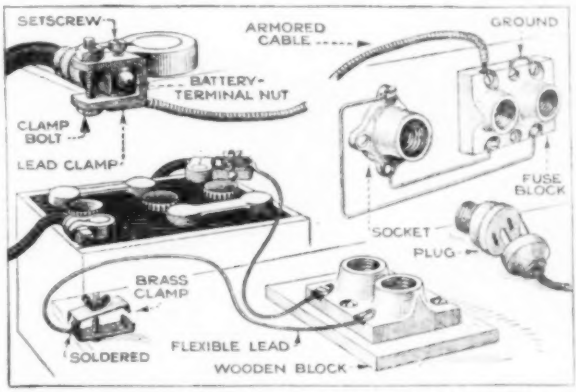
A permanent connection to the battery itself is better, and the opening through the battery box, where the regular lead comes through, is usually large enough to permit a second heavy wire to be brought out. A heavy lead clamp, as shown in the drawing, may be made, to fasten to the battery-terminal lug or nut, but great care must be taken in fastening this, to prevent it from working loose and causing a short circuit. In the drawing the clamp is shown held to the terminal nut by a nut and bolt; then a sharp-pointed brass setscrew is set into the lead nut to keep the clamp from slipping.

A flexible lead, preferably of armored cable, or heavy flexible wire incased in circular loom, is soldered or bolted to the clamp and brought out through the battery box alongside the regular lead wire. A standard porcelain-base double-plug fuse block is bolted to the frame, or dash, as close to the battery box as possible, to protect the battery and wiring from an accidental short circuit or overload. Beside the fuse block, a standard porcelain socket is mounted. If these parts are to be bolted direct to the frame, it is well to place rubber gaskets under the porcelain bases and rubber washers under the screw heads, in order to keep the vibration from loosening the fastening or breaking the porcelain.

The fuse block and socket may also be attached to a wooden block instead of directly to the frame. Unless the fittings are inside the dash, some sort of cover should be placed over them, except when in use, to keep out dirt and oil. If the lighting circuit is of the grounded type, one side of the socket is connected to the frame; otherwise, two leads must be brought from the battery.

To use the auxiliary lights, it is only necessary to remove the cover from the socket, and plug in with a standard porcelain attachment plug and cap, and none of the machine lights need be used.

In case a permanent installation is not desired, the outside leads may be directly connected to the fuse block, which is fastened to a piece of board, as shown in the lower drawing. Two heavy leads are attached to the other side of the fuse block and carried to the battery terminal and frame. Clamps are made from heavy spring brass and the flexible leads soldered to them; the end of the brass strips are bent over and teeth filed in them to grip the battery terminal. The necessary pressure is applied by wing-nuts and bolts. Both terminals may be gripped, or one clamp attached to the frame, if a grounded circuit is used. The fuse block is placed on the floor, or frame, as near the battery box as possible.

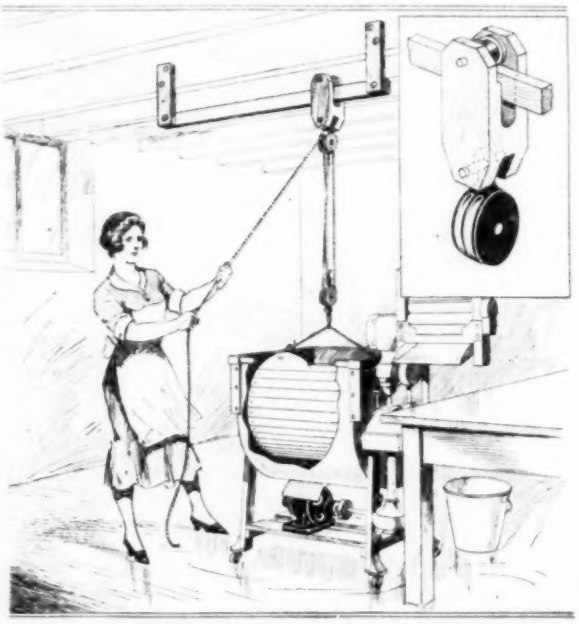


An Arrangement for Drawing Current from the Storage Battery of an Automobile for Lighting the Camp or Summer Cottage

The board, fuse block, and wire may be carried in the machine, or left in place and the machine driven up within reach for attaching. In use, the machine is driven into position, the floorboard removed, the clamps are attached to the battery terminals, or to one of the battery nuts and the frame as may be necessary, and the lights switched on. Of course, a socket and plug can be attached to the board as in the permanent installation. This last arrangement has been used to illuminate a small two-story ranch house with success, the automobile being kept on the ground floor and a lead of heavy lamp cord, with fuse block and clamps attached, being coiled up under the ceiling, ready and convenient for use in the evening.

Washing-Machine Cylinder Hoist

It is a back-breaking job to lift the wooden cylinder out of some types of electric washers after washing, and for this reason the cylinder is often left in the tub, which, of course, prevents it from drying thoroughly and may cause mildew. This trouble can be eliminated by providing a small hoist of the kind shown in the drawing. The block-and-tackle arrangement is suspended over the washing machine and enables a woman to raise the cylinder out of the tub with a minimum of exertion.



A Convenient Block-and-Tackle Arrangement Used for Hoisting the Cylinder Out of the Washing Machine

The essential parts of the arrangement are a single and double pulley, both about 1 in. in diameter, a wooden block, and some strong clothesline. The cylinder is attached to the single pulley with a length of rope, ⅜ in. holes being drilled in the sides about 1 in. from the ends to admit the hooks provided on the ends of the rope. Another length of rope is tied at one end of the single-pulley eye and passed over the pulleys as shown. This arrangement reduces the pull on the free end to one-third of the pull necessary if only one pulley be used. A cleat should be provided on the wall so that the rope can be tied while the cylinder is left suspended so it may dry.

The wooden block on which the double pulley hangs is not essential but is very convenient. It is made of oak about 8 in. in length, and runs on a wooden rail, supported by wooden hangers bolted to the ceiling joists with carriage bolts. The rail should be about 4 ft. long so that the cylinder can be swung clear of the washer and lowered to the floor.—Donald A. Price, Chicago Heights, Ill.

Firelight Photos

Numerous methods are suggested for coloring pictures to imitate firelight, most of them depending upon the staining of the entire picture with some dye, but few giving satisfactory results. However, a combination of dyeing and chemical toning will give a satisfactory effect. By staining an entire picture light orange and toning the dark portions red, a fine imitation of firelight is obtained.

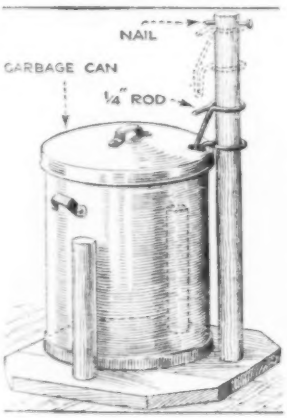
Any developing paper can be used. For the best results, the picture should be printed deeply; the print is first immersed in a bath consisting of 10 grs. of potassium iodide, and 20 grs. of potassium ferricyanide, dissolved in 1 oz. of water. This solution should be made in quantity as required, and the potassium must be the red prussiate crystals, not the yellow. The picture, immersed in this solution, will bleach away almost entirely, but must be left in the bath half an hour longer to convert the nitrate on the print completely into iodide of silver. This chemical is capable of taking up or "mordanting" many aniline dyes, but not all of them. The dye, which is red in case of firelight scenes, is then applied; lanafuschine is the dye to use. After washing out the dye completely, another color such as yellow or orange, in the case with campfire scenes, is applied to the print to stain it completely and to deepen the red tint in the shadows. In this way the print can be dyed almost any color and tint desired. A good dye is necessary for successful work. The quality of any red dye can be seen when the print is washed; if any of the whites remain tinted, the dye should be rejected.

This process of coloring can also be applied to moonlight pictures or landscapes, using blue or green dyes, or even liquid water colors with a brush, as the print will take almost any aniline dye. It is not necessary to place the print in the dye, but better to apply the dye with a brush, paying no attention to the outlines of the picture, as the dye will act only on the chemical portion. If the dye is not strong enough after washing, a second application is made.

This process is also a splendid one for coloring lantern slides, as the silver can be dissolved entirely in an ordinary fixing bath during the process. The slides will be of a soft and delicate appearance and can be tinted with water colors afterward. A French experimenter recommends the following dyes: For red, lanafuschine brilliante S L; blue, cyanol d' alizarine B F; yellow, jaune de quinoeline; green, vert brilliante d' alizarine; violet, violet lanacyl B.

A Garbage-Can Holder

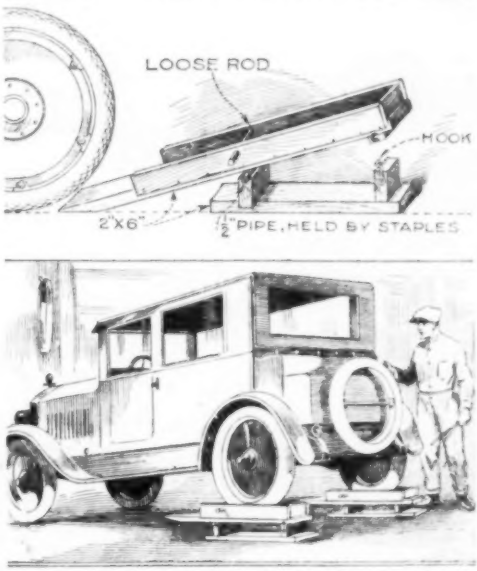
Keeping garbage and refuse in covered cans is a step toward prevention of disease, but it is of frequent occurrence that the garbage cans in alleys are accidentally tipped over by careless handling, by wagons and autos being driven against them, or by dogs, and the contents, emptied over the ground, become a breeding place for flies and bacteria. To prevent the cans being upset in this way, many people drive posts or iron pipes into the ground around them, but it then becomes quite a task to lift them out when they are full.



A much better method of holding them is shown in the illustration. This holder consists of a heavy wooden base and three uprights, the center one fitted with a catch made of ¼-in. iron rod and bent to the shape indicated. A slot or hole is cut in the cover to receive the end of the catch. When the can has to be removed, the catch is raised and the can pulled from under it.—E. K. Wehry, Cedar Rapids, Iowa.

"Automatic" Car Jack

When working on the rear end of an automobile, or under it, it is usually necessary to jack up one end of the car to provide more space to work. The illustration



A Pair of Simple Homemade Automobile Jacks that Are Not Only Convenient but Quite Safe

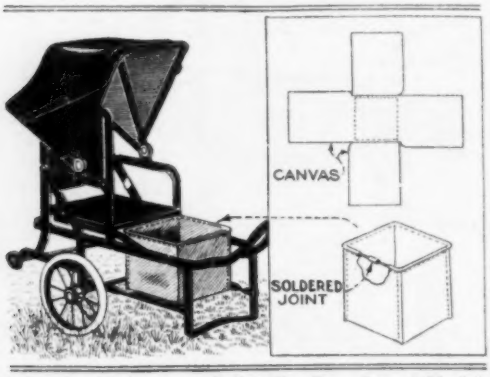
shows a pair of simple homemade jacks for this purpose. They are made of 2 by 6-in. unplaned lumber, and constructed as shown in the upper figure, each consisting of a 2 by 6-in. base, two support blocks, and a top board of the same material. The top board is pivoted on one of the support blocks by means of a piece of ½-in. iron pipe, loosely held in place by large staples; it must be about twice as long as the base and beveled at one end as shown, this end being slightly heavier than the other so that the board will fall to the position indicated in the upper figure.

The jacks are placed close to the wheels at the front or rear, and the car driven on. A hook is provided on one support block to keep the top board down, and a short length of iron pipe or rod, fitting loosely in holes drilled through the sides of the top, prevents the wheels from running off the jack while the work is being done, thus making the work perfectly safe.—F. S. Root, Fall River, Mass.

¶A worthless clock can be used in the sick room to indicate the next time medicine is to be given by setting the hand at the proper position.

Keeping Sulky Covers in Place

During cold weather when it is necessary to have the child well covered in the sulky, the blanket often works loose and one end drags in the mud or against one



A Canvas Basket on a Sulky Has Been Found Useful for Keeping the Blanket in Place

of the wheels. This trouble can be avoided by tucking the lower ends of the blanket into a small canvas "box" of the kind shown in the illustration.

The box is made of two strips of heavy canvas, 10 in. wide and 36 in. long. These strips are cut and placed across each other as shown in the upper detail, and sewed together as indicated by the dotted lines, the outer ends being hemmed. Through the hems a length of No. 8 wire is passed, which is bent to a square just a trifle larger than the width of the sulky frame, so that it will rest on the latter. The ends of the wire are soldered together, which is done by bending a small piece of tin around the wire and dropping solder between. If desired, the box can be made of black oilcloth to match the sulky frame. Besides keeping the blanket in place, the basket keeps the child's feet warm, and it can also be used to hold packages when shopping. When the sulky is folded the box is placed in the seat.—E. D. Fahling, Tama, Ia.

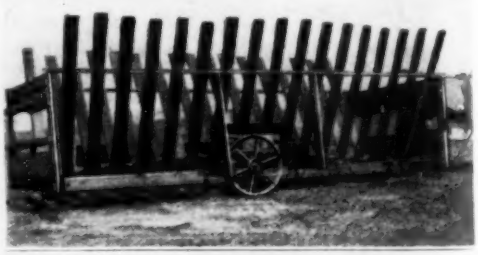
Increasing Effectiveness of Spot Light

Putting the automobile spot light in front of the radiator and down close to the ground has been found to increase its effectiveness considerably. This may be accomplished by clamping it to the bumper, body frame, apron, spring, or an auxiliary bracket bolted to the latter. It is not advisable to fasten it to the front axle, however, as the constant jarring will soon ruin the lamp. Care must be taken that the light is behind the bumper, to protect it from damage in case of a slight collision, and just high enough to clear obstructions in the road; the level of the axle is about the right height.

The advantage of this position is obvious; it brings the light down where it is needed and provides a strong light with a wide ray, which will not blind an approaching driver. In rain or foggy weather the usefulness of a spot light located in this position is unquestionable. A small push-button switch on the dash is connected in the circuit to operate the spot light independent of the other circuits. The wires are run under the frame or under the hood—N. T. Peterson, Corvallis, Ore.

Manuring the Farm Garden

One of the problems in keeping a large house garden on the farm is that the soil must usually be richer than the other farm land, and therefore it must be fertilized liberally. The usual farm manure spreader is not of much use for this purpose as it spreads the manure too thinly, and to spread the manure over a three-acre tract is too much work to be done with a fork. An Oklahoma farmer solved the problem by allowing his cattle to run in the garden during the winter. In order to have the manure spread evenly, he built the movable feed rack shown in the photo; moving the rack occasionally keeps the manure spread evenly over the garden. It consists of two wheels and an axle from an old



A Movable Feed Rack in the Farm Garden Tends to Effect an Even Distribution of Manure

mower, a frame of 2 by 6-in. lumber, and slats of 1 by 6-in. lumber.—J. M. Collins, Kansas City, Mo.

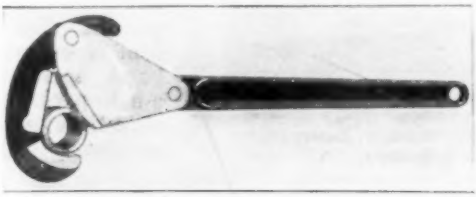
¶Pure benzine should be used to clean watch hair springs, and it should leave no film on the metal. Pure grain alcohol is also very effective, but denatured alcohol usually leaves a film.

AUTOMATIC PIPE WRENCH GRIPS LIKE HAND

Where an instant grip is important, without the necessity of adjustment, as in screwing up or loosening pipe in awkward positions, a pipe wrench recently put on the market will prove of great value.

The design of the curved jaw is such that a number of its teeth are in constant engagement, thus a uniform grip is obtained that will not permit the wrench to slip. This prevents wearing of the teeth, and crushing of the pipe.

The outstanding feature is the automatic action between the heavy jaw and the toothed head, with which a powerful grip is obtained by a simple push on the handle. It is unnecessary to put a hand on the head, which makes the wrench exceedingly useful in places where it is necessary to have one hand free, or in dangerous positions, as when tightening loose pipes or couplings where scalding steam is escaping. For gripping pipes or conduits which are known to be highly charged with electricity, an insulating covering for the handle is provided, which, with the one-hand action, makes the tool perfectly safe.

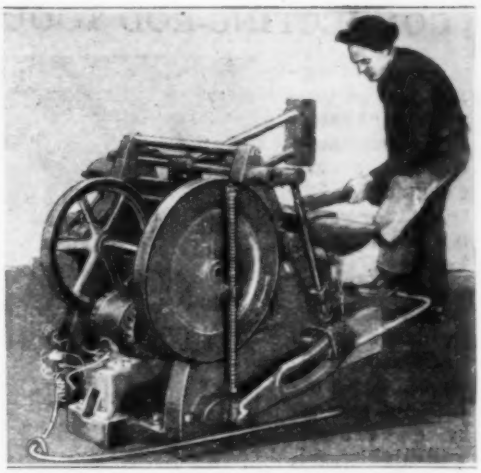


Automatic-Grip Pipe Wrench That will Not Slip or Crush the Pipe

POWER HAMMER IS ADAPTED FOR LIGHT SMITHING

Smithing work ordinarily performed under hand sledges, and too small to be forged under a steam hammer, may now be done by power, using a hammer recently placed on the market.

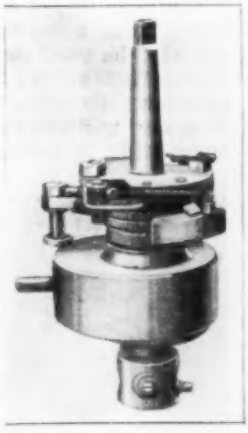
The tool will handle material up to 2½ inches thick, and the hammer is under the complete control of the smith, so that a blow of any desired force may be struck. The maximum blow is about four times as heavy as that delivered by a human helper or striker, and the machine attains a rate of 140 blows a minute. The hammer head can be traversed along the face of the anvil to any desired point by means of a pedal, so that there is no delay in locating the hammer over the hardy holes in the anvil, for swaging, punching, etc. The work is always struck exactly at right angles to its face, due to the parallel-arm mounting of the hammer, and the force of the blow is directly controlled by the amount of pressure applied to the foot pedal. The tool requires only 1 horsepower.



Forging Light Work with a New Power Hammer, Which Is under the Complete Control of the Smith

TAPPING ATTACHMENT SAVES TAPS

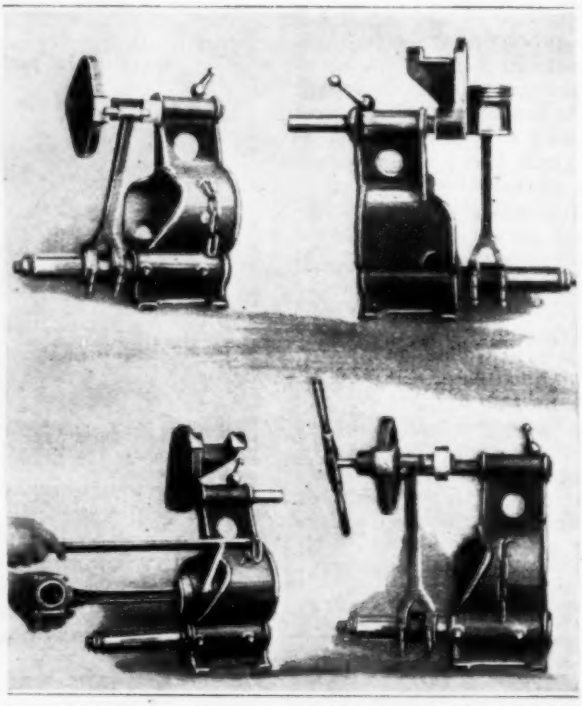
By controlling the driving force applied to the tap through springs, and eliminating the usual friction drive, it is possible, in a new tapping attachment, to set the spring tension accurately so as to allow over-running to occur with a minimum safety margin, before tap breakage or strain occurs. The setting remains constant, since lubrication and temperature conditions do not affect the spring tension. Hence considerable time is saved, and the tap is always run under the most effective cutting conditions. When once adjusted, the tapper will continue to function satisfactorily until a different job is to be set up. A tapper with these advantages will quickly save its initial cost by increasing production and reducing tapping expenses.



CONNECTING-ROD TOOL HAS WIDE RANGE OF USES

Connecting-rod and piston-alinement gauges are common enough, as are reaming fixtures for connecting-rod bearings, but a fixture that combines both operations is decidedly unusual. A portable tool recently developed will do this, and, in addition shave and burnish the big-end bearings, eliminating scraping.

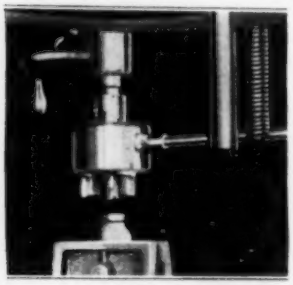
The lower part of the frame of the tool carries the shaving and burnishing arbor, which is adjusted, for both operations, by means of micrometer screws. The upper part of the fixture carries a gauge attachment that not only is used for gauging the alinement of wristpins and pistons, but also as a guide for reaming the wristpin bearings. A short chain is attached to the body of the tool, and a lever may be used in connection with this for forcing wristpins out of pistons. The tool is entirely hand operated, and performs six different operations.



Upper Left, Testing Alinement of Wristpin; Upper Right, Testing Piston; Lower Left, Forcing Out Wristpin; Lower Right, Reaming Wristpin Bushing

MILLING TOOL PRODUCES FINISHED HEXAGONS

While intended primarily for work on valve nuts, a new hexagon-milling tool can also be used in the production of oil cups, "locomotive nuts," gauges, and plumbing fixtures. The tool will drill, face, and mill the sides of the hexagon at once; this is accomplished by a simple planetary motion of three cutters, each having two cutting edges. The sides of the hexagon are not perfectly straight across, but the curvature produced is so slight that it is not at all objectionable. The tool can be used in an ordinary drill press, in conjunction with a simple fixture to hold the work and guide the body of the tool. The cutters are easily removed, sharpened, and replaced, and are interchangeable. The miller is made for pipe sizes running from ⅜ to 1½ in. but can be equipped with cutters to suit any standard.



COPPER-ALUMINUM ALLOY HAS MANY USES

A new alloy of copper, aluminum, and iron, which can be applied to an unusual number of purposes, has recently become available. It is lighter than steel, while possessing a tensile strength of 75,000 to 100,000 pounds per square inch.

The alloy is made in various grades, for different uses. The softest grade may be used for packing, or parts requiring a soft bronze; the next grade for bearings on high-speed machines, or where light pressures are the rule; and the third grade, for bearings, bushings, gears, worms, etc., where extreme toughness and resistance to wear are required. Both of the latter grades rapidly take on a surface like polished glass, and will not crystallize. A fourth grade is highly resistant to the action of most commercial acids and alkalies, and of superheated

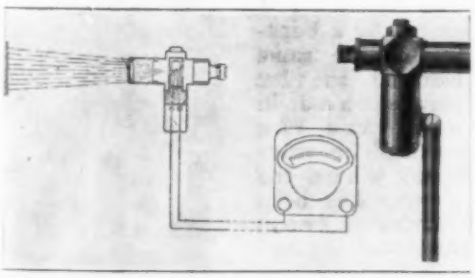
steam, and is of exceptional strength; the hardest grade is used where conditions demand a metal harder than chrome-nickel steel, and it practically cannot be machined. The alloy is of a bright golden-yellow color, is easily polished, and does not tarnish. It can be forged, cast, drop-forged, rolled, and drawn; it is not affected by heat, and annealing does not take out its spring.

PYROMETER MEASURES HEAT RADIATED FROM WORK

Utilizing the direct heat radiated from the body of which the temperature is to be measured, a pyrometer radically different from others of the same general type, has now made its appearance.

The instrument is small and compact, and may either be used as a portable pyrometer or permanently installed at the measuring point, giving continuous and accurate readings on either indicating or recording instruments. It may be installed in places where neither rare nor base-metal couples can be employed.

A lens in the radiation set collects the heat rays and focuses them on a small element inclosed in a glass tube from which the air is exhausted. The thermo-element generates a small electric current, which is measured, in the usual manner, on indicating or recording instruments. At the opposite end from the objective or collector lens is the ocular lens for focusing the instrument. For very high temperatures, with glaring



Left, Sectional View of Pyrometer, Showing Lens System and Wiring; Right, Complete Pyrometer

rays, a red glass is placed over the eyepiece, so that adjustments may be made accurately, without harm to the eyes.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

SINGLE-SPEED WOOD LATHE FOR SMALL WORK

Small turning operations, which make up a great share of the work in many

Single-Speed Woodturning Lathe with Direct-Drive Motor Headstock

woodworking plants, may be done very speedily and economically on a new lathe.

The ¼-hp. driving motor is built into the headstock, and is completely inclosed. It is directly connected to the spindle, which is mounted on ball bearings, and runs at a constant speed of 3,400 r.p.m. This speed, the makers claim, is scientifically and practically correct for work up to 6 in. in diameter—the maximum capacity of the lathe. The swing is full 5 in. over the tool rest, 7 in. on the faceplate, and 24 in. between centers.

The machine can be moved at will, but is heavy enough to stand rigidly without vibration.

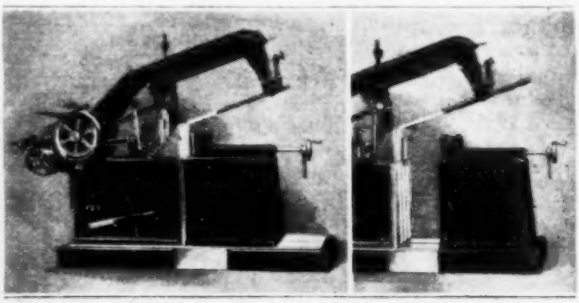
REDMANOL CUT-OFF WHEELS LATEST DEVELOPMENT

Carborundum cut-off wheels are now being marketed in which the binding element is a phenol resin of the same family as bakelite. This will not soften or melt, and gives an open, porous wheel structure that tends to produce a free, clean-cutting wheel, which will cut without binding.

It is claimed that these wheels effect considerable saving in time, stock, and labor in cutting stellite, high-speed steel, general steel alloys, and miscellaneous cut-off work. The diameters range from 8 to 14 in.; thicknesses from $\frac{3}{64}$ to $\frac{1}{8}$ inch.

POWER HACKSAW HAS GAP IN HEAD

Utilizing the principle of the gap-bed lathe, a 13 by 16-in. power hacksaw of a new type has just been announced. When the gap is closed, the saw can be used for ordinary purposes, while, with the gap open, it has an excess work-holding capacity of 24 in. in height, and 16 in. in width, making the total capacity 16 by 37 inches.



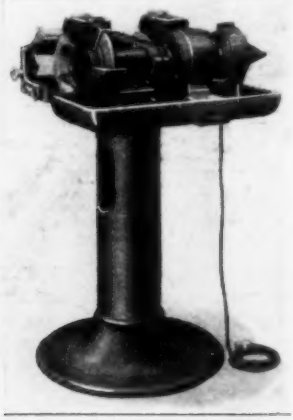
Left, Hacksaw with Gap Closed, as Used for Ordinary Work; Right, Gap Open for Large Work

With the gap open, the work can be clamped either to the finished vertical face of the bed, where four T-slots are provided, or directly to the base, which is provided with three clamping slots. The base has a water trough extending entirely around it, which carries the cooling medium back to a reservoir located at the rear of the base, from whence it is pumped into a distributing pipe.

The machine is equipped with a six-speed stroke mechanism, and the blade pressure or feed can be varied at will.

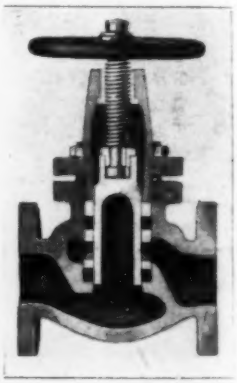
OILSTONE GRINDER SHARPENS WOODWORKERS' TOOLS

Plane bits, chisels, gouges, and other woodworkers' tools, which usually are ground on grindstones and edged on oilstones, may now be sharpened on an oilstone grinder. The machine is equipped with two oilstone wheels, kept constantly saturated with kerosene, or other oil, which flows, by capillary action and centrifugal force, from the centers of the stones to their outer surfaces, thus keeping the pores free cutting. The stones are effectively guarded, and are arranged with a table that acts as a tool rest. The table is also equipped with a sliding tool-holder, which has a micrometer feed. A cone, and a leather stropping wheel are mounted directly on the motor shaft. The cone is used for the inside of curved edges, irregular-shaped tools, etc., and the stropper for removing burrs, and for smoothing cutting edges. The machine is so arranged that four workmen can use it at once; it may be operated from a lamp socket, and, as it need not be bolted down, used wherever current is available.



REGRINDING IS UNNECESSARY WITH "SEATLESS" VALVE

Freedom from the usual troubles associated with valve seats is assured in the design of one recently introduced. This valve is closed and opened by means of a smooth cylindrical plunger moving through two jointing rings of flexible material, separated by a bushing of the same material as the plunger, and in which are the ports. The valve opens when the plunger has been withdrawn from the lower ring, and only the lower end of the plunger is exposed to the scoring action of the steam or gas, which does not touch the softer material. Even the scoring away of ½ inch of the plunger has no effect on the tightness of the valve when closed. There is no stuffing box, as the screwed spindle is cut off from the body of the valve by the upper jointing ring. The valve is kept tight simply by screwing down the gland nuts.



Prize Offers and Announcements

THOUSANDS OF DOLLARS AND GOLD MEDAL IN ADVERTISING PRIZES

In an effort to improve advertising, Edward W. Bok, donor of the world peace plan prizes, will give a gold medal and $8,500 annually. For the year October, 1923, to October, 1924, the awards will be grouped under three classifications. The gold medal will be given to the individual who is voted to have done the most to raise the standards of advertising during the year; three prizes of $1,500 each will be awarded for planning advertising campaigns and for research work in the field; four awards of $1,000 each will be presented for individual advertisements of excellence. The prizes will be known as the Harvard Advertising Awards and will be distributed by the graduate school of Harvard University.

THOUSANDS OF DOLLARS FOR "FIRST NOVEL" OFFERED IN COMPETITION

Any resident of the United States who has not already published a novel in book form is eligible to a prize of $13,500 to be given through Curtis Brown, Ltd., literary agents of New York City, for a story which is considered best for publication as a book, a magazine serial, or for adaptation as a motion picture. Any book royalties that run over $1,000 will go to the author on usual terms. The prize is offered by Dodd, Mead & Co., Pictorial Review and the Famous Players Lasky Company. Manuscripts should be in the hands of the agents at 116 West Thirty-ninth Street, New York City, before June 1, 1924.

FIFTY HEALTH COURSE SCHOLARSHIPS TO BE AWARDED TO TEACHERS

Elementary teachers in the first nine grades in cities of 50,000 population or over are eligible to fifty scholarships of $500 each for a year's study in health education at an accredited institution. The awards are made by the American Child Health Association, 370 Seventh Avenue, New York City, of which Herbert Hoover is president, and the Metropolitan Life Insurance Company. They are given to raise the standards of health education throughout the country. Twenty teachers in each city must compete, and the work on which they will be judged must cover a period of six consecutive months ending not later than May 15, 1924.

TWO THOUSAND DOLLARS OFFERED WRITER OF ADVENTURE STORY

Royalties and a prize of $2,000 are offered by the Atlantic Monthly Press, 8 Arlington Street, Boston, Mass., for an adventure story, not less than 60,000 words in length, on the character and excellence of the stories of the late Charles Boardman Hawes, after whom the award is named. Manuscripts must be sent in before October 1, 1924. Interest of plot and of actors in the story will be considered in making the decision.

POET WHO WRITES SONNETS ABOUT CITIES TO WIN SEVENTY-FIVE DOLLARS

To increase interest in the sonnet form of poetic expression, Poetry Review offers a prize of $75 for the best sonnets about cities. Preference will be given to poems in the strict Petrarchan form. The contest closes May 31, 1924. Entries should be sent to Mrs. Alice Hunt Bartlett, American Editor, Poetry Review, 27 West Sixty-seventh Street, New York City.

NEWSPAPERS OFFER SMALL CASH PRIZES FOR JOKES, RECIPES AND SAYINGS

For short letters containing suggestions for menus, recipes, bright sayings of children, jokes and many other anecdotes, the following publications pay from $1 to $5 for material accepted:—The Chicago Sunday Tribune; Boston Advertiser; Wisconsin News, Milwaukee, Wis.; Plain-Dealer, Cleveland, Ohio; Daily News, New York; Good Housekeeping, 119 West Fortieth Street, New York; Household Journal, Batavia, Ill.; Grit, Williamsport, Pa.; Science and Invention, 233 Fulton Street, New York; Woman's World, 107 South Clinton Street, Chicago, Ill.; Farm Journal, Philadelphia, Pa.; Boston Post; Courier Journal, Louisville, Ky.; St. Louis Sunday Globe Democrat; The Denver Post, Denver, Colo.; Washington Post; Home Occupations, Des Moines, Iowa.

AWARDS TO SCHOOL CHILDREN TOTAL THREE THOUSAND DOLLARS

Prizes totaling $3,000 will be awarded school children for the best essays of 500 words or less on the subject "The Characters I Liked Best in David Copperfield and Why," or "What Scenes and Characters I Should Like to See Included in a Seven-Reel Motion Picture of David Copperfield." Contestants twelve years old, or younger, are eligible to the first subject, those thirteen years, or over, to the second. Essays should reach Encore Pictures, 35 West Forty-fifth Street, New York City, before midnight, March 3, 1924.

STORIES OF THRILLING EXPERIENCES TO WIN FIFTY DOLLARS

Three prizes, $25, $15 and $10 are offered for the best stories submitted to the "My Most Thrilling Experience" department, of Ace-High Magazine. Narratives must not exceed 2,000 words in length and the veracity of the details should be vouched for by some responsible person. Manuscripts should be sent to the Reader's Publishing Corporation, 799 Broadway, New York City.

ESSAY ON "WORLD RENAISSANCE" TO WIN ONE THOUSAND DOLLAR AWARD

Orient, 132 Nassau Street, New York City, will award $1,000 to the writer of the best essay on "The World Renaissance," the subject for the 1924 competition conducted by the magazine. The purpose of the contest is "to bring together the elite of the East and West in the domain of art, literature and science."

FIVE HUNDRED DOLLARS FOR BEST ESSAY ON MAN WHO BEFRIENDED COLUMBUS

For the best essay on Archbishop Diego de Deza, who as exchequer of the Kingdom of Seville and confessor of Queen Isabella and King Ferdinand, befriended Christopher Columbus when he was seeking aid to make his voyage of discovery, $500 will be paid. Manuscripts should be sent to Rev. Thomas M. Schwertner, O. P., editor of the "Rosary Magazine," 939 Lexington Avenue, New York City.

SINGLE SONNET OR GROUP WILL REWARD WRITER ONE HUNDRED DOLLARS

One hundred dollars have been offered through "The Bookfellows" for the best sonnet or group of sonnets submitted before April 1, 1924. Details of the contest may be learned from Flora Warren Seymour, 4917 Blackstone Avenue, Chicago, Ill.

TWO HUNDRED PRIZES TO TEXTILE MEN FOR PRACTICAL SUGGESTIONS

Two hundred and sixteen prizes, ranging from $100 to $5 each, $2,000 in all, are offered to textile men for discussions concerning various manufacturing branches of the industry, factory management, suggestions for improving processes, uses, defects discovered and ways that have been evolved for meeting problems of the trade. Articles should be sent to the editor of The American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.

HIGH SCHOOL OR COLLEGE STUDENTS PAID FOR WINNING ESSAYS IN MAGAZINE

Students regularly enrolled in high schools or colleges that use the Atlantic Monthly as a textbook are eligible to prizes of $50, $25, and $10 offered in an essay contest. Six awards in all will be given, three to high school and three to college students. Essays submitted must be endorsed by the instructor and must reach the Atlantic Monthly Company, 8 Arlington Street, Boston 17, Mass., by April 12, 1924.

BOYS AND GIRLS UNDER SIXTEEN TO GET PRIZES FOR ESSAYS ABOUT PAINT

Boys and girls under sixteen years of age are to be given 403 prizes of $100 to $1 for stories not over one hundred words in length describing some article in the home that needs paint or varnish and for lists of neglected surfaces observed in buildings, offices, stores and other places. Addresses of the owners of the buildings should be sent. The contest closes March 1, 1924. Stories must be addressed to Prize Committee, Save the Surface Campaign, Box 60, The Bourse, Philadelphia.

ONE HUNDRED DOLLARS ROYALTY OFFERED FOR THREE-ACT PLAYS

Royalties of $100 for two or three performances will be paid by the Drama Branch of the Community Arts Association of Santa Barbara, Calif., for original three-act plays submitted directly by the authors.

Science Notes for Daily Use

GAS TO COOK DINNER FOR SIX PERSONS COSTS LESS THAN FOUR CENTS

Sufficient gas to prepare a dinner for six persons costs only 3.3 cents at the rate of $1.00 per 1,000 cubic feet, according to experiments recently conducted by the United States Department of Agriculture. The entire cost of the meal consisting of Swiss steak, escalloped potatoes, spinach, bread, butter, rice pudding, coffee, cream and sugar was $1.474 at current market prices.

HOW BEES KEEP WARM IN HIVES

When the temperature falls to fifty-seven degrees Fahrenheit or below, bees in their hives form clusters about the combs to keep warm. Beating their wings and wriggling about, those on the inside of the mass, generate heat which warms the others. Those on the outside lie still and close together, forming almost perfect insulation. Tests have shown that this method is so effective that there may be seventy-five degrees difference in temperature between the interior and exterior of the cluster within a distance of only four and one-half inches. Bees have been known to work themselves to death trying to keep warm.

ETHER INJECTED INTO BACKWARD BUSHES STIMULATES GROWTH OF BUDS

Ether injected into the base of rose bushes, or other shrubs, that are backward, will cause dormant buds to swell and the plant will regain a healthy condition, according to experiments made by Prof. David Lumsden of the federal horticultural board. The drug is administered by a hypodermic needle at the base of the stem and near the roots. Only a few drops are needed, and after this treatment, the bush is said to be immune from ordinary diseases.

ONLY RED-BLOODED ANIMALS ARE HARMED BY CARBON MONOXIDE GAS

Only slight injury is caused by carbon monoxide gas to animals that do not have red blood, reports of specialists of the United States Department of the Interior show. Cockroaches were kept alive without lessening their activities at an experiment station in Pittsburgh in an atmosphere which contained sixty per cent carbon monoxide gas and only twenty per cent oxygen. The presence of live roaches in mines was thus shown to be no indication that the air is safe for men to breathe. The most reliable tests for poisonous gases in mines are made with canaries. These birds are so sensitive to the carbon monoxide, and other deadly fumes, that they have been known to be overcome in three or four minutes when there was only .25 per cent of the gas in the air.

OZONE AS AN AIR-PURIFIER

Tests to determine the value of ozone for purifying the air in buildings are being made by the United States Department of the Interior in co-operation with the bureau of mines. In the oxidizing powers of the gas, engineers see possibilities that may make it valuable in refreshing the air, removing odors and destroying bacteria. Ozone has also been proposed for bleaching and sterilizing textiles. The tests are expected to show whether injurious oxides of nitrogen are produced by the gas, to what extent it can be employed without harmful effects to breathing and ways to measure the quantity of ozone and oxides in air so treated. Tests, so far have shown, it is said, that oxides are not produced in harmful amounts by ozone ventilation apparatus.

WIRE SCREENS FINER THAN SILK CLOTH TEST QUALITY OF CEMENT

Wire sieves of finer texture than that of silk cloth are required in testing various grades of cement. Ordinary silk dress lining contains 81 threads to the inch, a silk handkerchief of good quality, 110 threads and the best silk dress goods, 187 threads. But to sift the fine cement dust, a screen with 200 wire threads, each smaller than a human hair, is required. There are 40,000 holes to the square inch in a sieve of this kind, and a mile of the slender wire is needed to weave a square foot of the mesh.

AFTERNOON HOURS WETTEST OF THE DAY WEATHER RECORDS SHOW

Late afternoon and evening hours from five o'clock to eight o'clock are the wettest, according to records of the weather bureaus. In some parts of the country, twice as much rain falls between those hours as does from nine o'clock in the morning until noon. This is due to the fact that in the morning hours, rising temperatures enable the atmosphere to hold more moisture, and when the mercury falls in the later hours, cooling currents cause rain fall. This peculiarity is more pronounced in warm than in cool weather, and is illustrated by frequent thundershowers in the afternoons.

PANELS OF WOOD STRIPS GLUED TOGETHER ARE STRONGER THAN STEEL

Panels of plywood, thin layers of wood cut by machine and glued together so that the grain of one layer is at angles to that of the two adjacent layers, are stronger than those made of steel, experiments have proved. The method of construction has been particularly valuable in building airplanes. Before it was known, wing ribs of wood weighed 7.95 ounces and were capable of holding a weight of only nineteen pounds. Those made of plywood are now able to hold a weight of 274 pounds and weigh only 5.12 ounces.

REMOVING ODORS FROM MILK

Unpleasant odors in milk, frequently caused by various kinds of green feed given to the cows just before milking time, are largely eliminated by aerating the milk in specially prepared apparatus and in changing the feeding hour. Tests made by the United States Department of Agriculture show that green alfalfa, corn and turnips eaten by cows just before they were milked produced strong odors. Fifteen pounds of turnips fed an hour before milking time resulted in noticeable taints, while increasing the amount to thirty pounds greatly intensified them. The quantity fed after milking had practically no effect. Although careful aeration has been found to remove many odors, some of them cling in the cream.

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